FEBRUARY
1956
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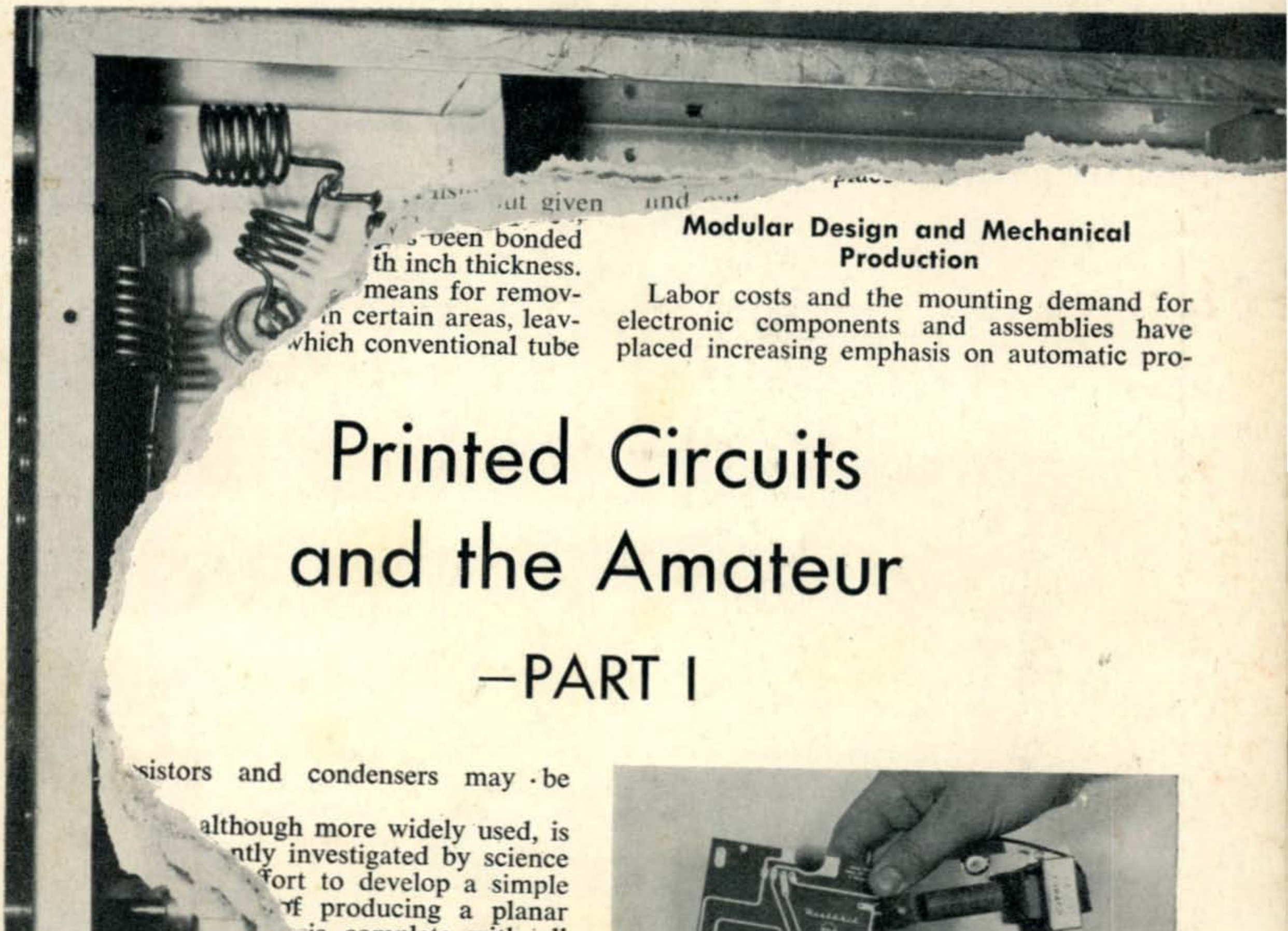
CQ
RADIO AMATEURS' JOURNAL



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Modular Design and Mechanical Production

Labor costs and the mounting demand for electronic components and assemblies have placed increasing emphasis on automatic pro-

Printed Circuits and the Amateur

—PART I

...sistors and condensers may be
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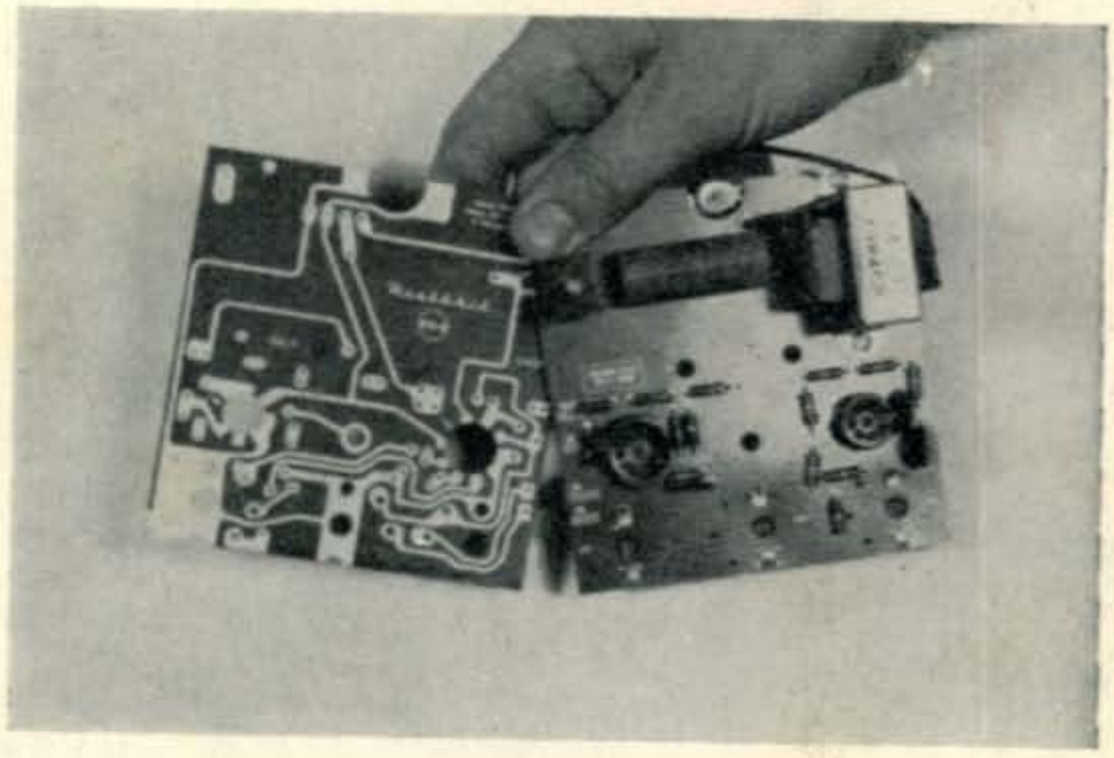


Fig. 1. Example of commercially available etched circuit boards in kit form. Courtesy Heath Company, Benton Harbor, Michigan.

In This Issue

Another Antarctic Expedition calls on COLLINS for communication

U.S. Navy Task Force 43 is establishing several bases in Antarctica in conjunction with the International Geophysical Year activities. Two bases will be built next year, one of them at the South Pole. The expedition, appropriately entitled "Operation Deepfreeze," is under the direction of Rear Admiral Richard E. Byrd and commanded by Rear Admiral George Dufek. For radio contact between bases and the outside world, the commercial and amateur communication equipment will be Collins.

The name Collins has figured prominently in polar expeditions since 1925. During Admiral Byrd's expedition of the early 30's, Collins transmitters were used in the first Arctic/Antarctic communication link—from the Byrd Expedition (Antarctic) to a CBS station in Northern Alaska. The Collins equipment is specially packaged for air drop and long sledge journeys. Superior performance and reliability, proven time and again, make Collins the logical choice when the need for radio communication is vital.

Collins CREATIVE LEADERSHIP IN ELECTRONICS

COLLINS

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA; WASHINGTON, D. C.; DALLAS, BURBANK, NEW YORK; COLLINS RADIO COMPANY OF CANADA, LTD.; OTTAWA, COLLINS RADIO COMPANY OF ENGLAND, LTD., LONDON

NOW AVAILABLE AT NO EXTRA COST

SSB

PR CRYSTALS FOR 75 METER AND 20 METER PHONE...IN THE 5 TO 5.5 MC. RANGE

Now you can enjoy commercial crystal stability on SSB at amateur prices. Because of increased demand, PR is now making available Type Z-2 Crystals in the 5 to 5.5 MC. range at $2.95 . . . for use with SSB exciters, such as the 10B and 20A for operation in the 75 meter and 20 meter phone bands. Pick your frequencies (integral kilocycle) and order from your dealer at this new, low price. Formerly PR crystals in this range were available only in commercial types selling for several times this amount.

$2.95

5.0 MC. to 5.5 MC. Range

On SSB, where stability becomes of utmost importance, there's nothing like crystal control with PRs . . . negligible drift (limited to less than 2 cycles per MC. per degree C). You can avoid the continuous annoyance of drift by depending on PRs . . . then you KNOW where you are, *and you know you will stay there!*

PR Crystals

Since PR CRYSTALS 1934

USE PR AND KNOW WHERE YOU ARE

PETERSEN RADIO COMPANY, INC.
2800 W. BROADWAY • COUNCIL BLUFFS, IOWA

EXPORT SALES: Royal National Company, Inc., 8 West 40th Street, New York 18, N. Y., U. S. A.

QUALITY PRODUCTS BY B&W

5100-B TRANSMITTER

Unsurpassed performance on CW, AM, and SSB. High level AM telephony—push-to-talk; clean CW keying—break-in on all bands; superlative SSB performance on all bands with the 51SB-B Sideband Generator. Input power 180 watts CW-SSB, 140 watts AM phone. Integral VFO or crystal control for 80 to 10 meter bands. Pi-network final followed by low-pass filter, and functional design throughout, keep TVI to an absolute minimum. Completely unitized construction.

Net Price $475.00

LOW PASS FILTERS

Fight TVI by attenuating undesirable harmonics and spurious radiation by a minimum factor equal to 17,780 to 1 with this new B&W low pass filter. Wave Guide principle and novel multi-sectional construction mean more attenuation in less space at lower cost.

Net Price, Either Model, $14.85

SINGLE SIDEBAND GENERATOR

The 51SB generator offers sparkling SSB performance with your present B&W, Collins, or Johnson transmitter, on 80 through 10 meters with the output frequency control presently in your transmitter.

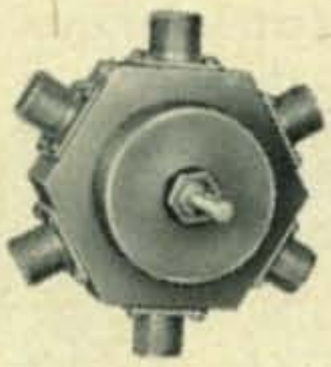
Net Price $279.50

MATCHMASTER

Three valuable instruments in one, the Matchmaster can be used as a dummy load, direct-reading r-f wattmeter, and an integral SWR bridge, for fast measurements on coaxial feed lines, antennas, and transmitting equipment.

Net Price $47.50

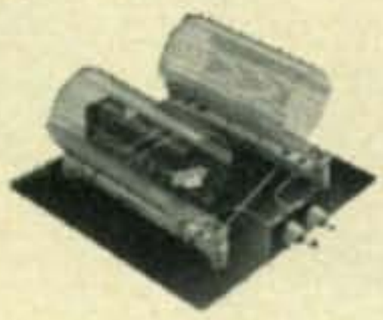
COAXIAL SWITCHES



Model 550-A permits instant selection of any one of five 52 or 75 ohm lines. Model 551-A is a 2-pole, 2-position type used for switching various devices in or out of series connection with coax lines.

Net Price:
Model 550-A ..$8.25
Model 551-A ..$7.95

BALUN INDUCTORS



Two of these multi-band balun coils assure maximum transfer of power from transmitter to antenna, efficiently matching 75 ohm unbalanced outputs to 75 and 300 ohm balanced feed lines.

Net Price Each
Coil $3.75

WATCH FOR the big value announcement on B&W's new L-1000A 1 KW Single Sideband Linear Amplifier!

All prices subject to change without notice.

ALL OF THESE FINE B&W products are available at leading distributors' everywhere.

Barker & Williamson, Inc.

237 Fairfield Ave., Upper Darby, Pa.

CQ, The Radio Amateurs' Journal

February 1956
Vol. 12, No. 2

Feature Articles

Departments

Miscellaneous

CQ—(title Reg. U.S. Post Office)—is published monthly by Cowan Publishing Corp. Executive and Editorial offices, 67 West 44th Street, New York 36, N. Y. Phone MUrray Hill 7-2080. 2nd Class Mail privileges authorized at New York, N. Y. Subscription rates in U.S.A., Possessions, APO FPO, Canada & Mexico, 1 year $4.00; 2 years $7.00; 3 years $10.00. Pan-America and Foreign, 1 year $6.00; 2 years $11.00; 3 years $16.00. Single copies 50 cents. Printed in U.S.A.

POSTMASTER: SEND FORM 3579 to CQ, 67 WEST 44th ST., NEW YORK 36, N. Y.

New HEATHKIT DX-100

PHONE AND CW TRANSMITTER KIT

MODEL DX-100

Shpg. Wt. 120 lbs.

$189.50

Shipped motor freight unless otherwise specified. $50.00 deposit with C.O.D. orders.

- **R.F. output 100 watts Phone, 125 watts CW.**
- **Built-in VFO, modulator, power supplies. Kit includes all components, tubes, cabinet and detailed construction manual.**
- **Crystal or VFO operation (crystals not included with kit).**
- **Pi network output, matches 50-600 ohms non-reactive load. Reduces harmonic output.**
- **Treated for TVI suppression by extensive shielding and filtering.**
- **Single knob bandswitching, 160 meters through 10 meters.**
- **Pre-punched chassis, well illustrated construction manual, high quality components used throughout—sturdy mechanical assembly.**

This modern-design Transmitter has its own VFO and plate-modulator built in to provide CW or phone operation from 160 meters through 10 meters. It is TVI suppressed, with all incoming and out-going circuits filtered, plenty of shielding, and strong metal cabinet with interlocking seams. Uses pi network interstage and output coupling. R.F. output 100 watts phone, ... 125 watts CW. Switch-selection of VFO or 4 crystals (crystals not included).

Incorporates high quality features not expected at this price level. Copper plated chassis—wide-spaced tuning capacitors — excellent quality components throughout—illuminated VFO dial and meter face—remote socket for connection of external switch or control of an external antenna relay. Preformed wiring harness—concentric control shafts. Plenty of step-by-step instructions and pictorial diagrams.

All power supplies built-in. Covers 160, 80, 40, 20, 15, 11 and 10 meters with single-knob bandswitching. Panel meter reads Driver I_P Final I_G, I_P, and E_P, and Modulator I_P. Uses 6AU6 VFO, 12BY7 Xtal osc.-buffer, 5763 driver, and parallel 6146 final. 12AX7 speech amp., 12BY7 driver, push-pull 1625 modulators. Power supplies use 5V4 low voltage rect., 6AL5 bias rect., 0A2 VFO voltage reg., (2) 5R4GY hi voltage rect., and 6AQ5 clamp tube. R.F. output to coax. connector. Overall dimensions 20⅞" W x 13¾" H x 16" D.

Heathkit ANTENNA COUPLER KIT

MODEL AC-1

$14.50 Shpg. Wt. 4 lbs.

Poor matching allows valuable communications energy to be lost. The Model AC-1 will properly match your low power transmitter to an end-fed long wire antenna. Also attenuates signals above 36 Mc, reducing TVI. 52 ohm coax. input—power up to 75 watts—10 through 80 meters—tapped inductor and variable condenser—neon RF indicator—copper plated chassis and high quality components.

Heathkit GRID DIP METER KIT

MODEL GD-1B

$19.50 Ship. Wt. 4 lbs.

The invaluable instrument for all Hams. Numerous applications such as pretuning, neutralization, locating parasitics, correcting TVI, adjusting antennas, design procedures, etc. Receiver applications include measuring C, L and Q of components—determining RF circuit resonant frequencies.

Covers 80, 40, 20, 11, 10, 6, 2, and 1¼ meter Ham bands. Complete frequency coverage from 2—250 Mc, using ready-wound plug-in coils provided with the kit. Accessory coil kit, Part 341-A at $3.00 extends low frequency range to 350 Kc. Dial correlation curves furnished.

Compact construction, one hand operation, AC transformer operated, variable sensitivity control, thumb wheel drive, and direct reading calibrations. Precalibrated dial with additional blank dials for individual calibration. You'll like the ready convenience and smart appearance of this kit with its baked enamel panel and crackle finish cabinet.

Heathkit ANTENNA IMPEDANCE METER KIT

MODEL AM-1

$14.50 Shpg. Wt. 2 lbs.

Use the Model AM-1 in conjunction with a signal source for measuring antenna impedance, line matching purposes, adjustment of beam and mobile antennas, and to insure proper impedance match for optimum overall system operation. Will double, also, as a phone monitor or relative field strength indicator.

100 μa. meter employed. Covers the range from 0 to to 600 ohms. Cabinet is only 7" long, 2½" wide, and 3¼" deep. An instrument of many uses for the amateur.

HEATH COMPANY

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 12, MICHIGAN

New Heathkit VFO KIT

MODEL VF-1

$19.50

Ship. Wt. 7 lbs.

- Smooth acting illuminated and precalibrated dial.
- 6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.
- 10 Volt average output on fundamental frequencies.
- 7 Band calibration, 160 through 10 meters, from 3 basic oscillator frequencies.

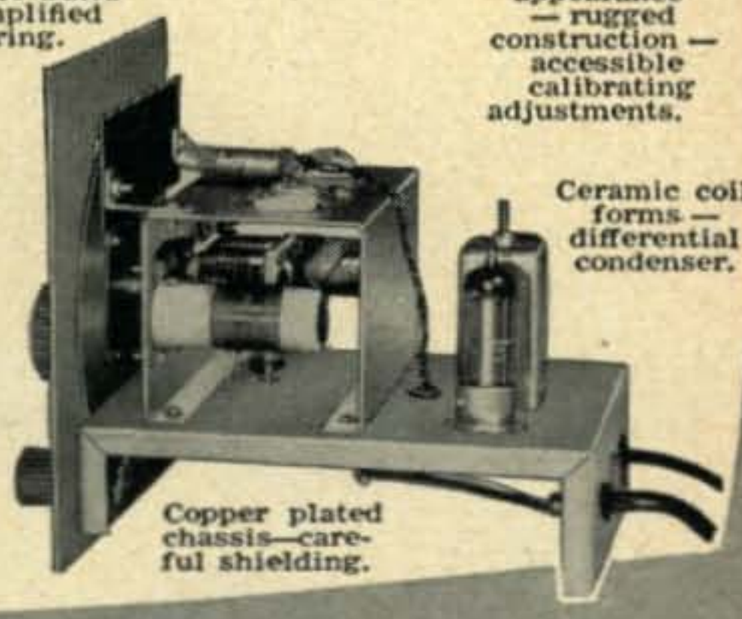
Here is the new Heathkit VFO you have been waiting for. The perfect companion to the Heathkit Model AT-1 Transmitter. It has sufficient output to drive any multi-stage transmitter of modern design. A terrific combination of outstanding features at a low kit price. Good mechanical and electrical design insures operating stability. Coils are wound on heavy duty ceramic forms, using Litz or double cellulose wire coated with polystyrene cement. Variable capacitor is of differential type construction, especially designed for maximum bandspread and features ceramic insulation and double bearings.

This kit is furnished with a carefully precalibrated dial which provides well over two feet of calibrated dial scale. Smooth acting vernier reduction drive insures easy tuning and zero beating. Power requirements 6.3 volts AC at .45 amperes and 250 volts DC at 15 mills. Just plug it into the power receptacle provided on the rear of the AT-1 Transmitter Kit. The VFO coaxial output cable terminates in plastic plug to fit standard ½" crystal holder. Construction is simple and wiring is easy.

Open layout,— easy to build — simplified wiring.

Smooth acting illuminated dial drive.

Clean appearance — rugged construction — accessible calibrating adjustments.



Ceramic coil forms — differential condenser.

Copper plated chassis—careful shielding.

Heathkit AMATEUR TRANSMITTER KIT

MODEL AT-1

$29.50

Ship. Wt. 16 lbs.

SPECIFICATIONS:

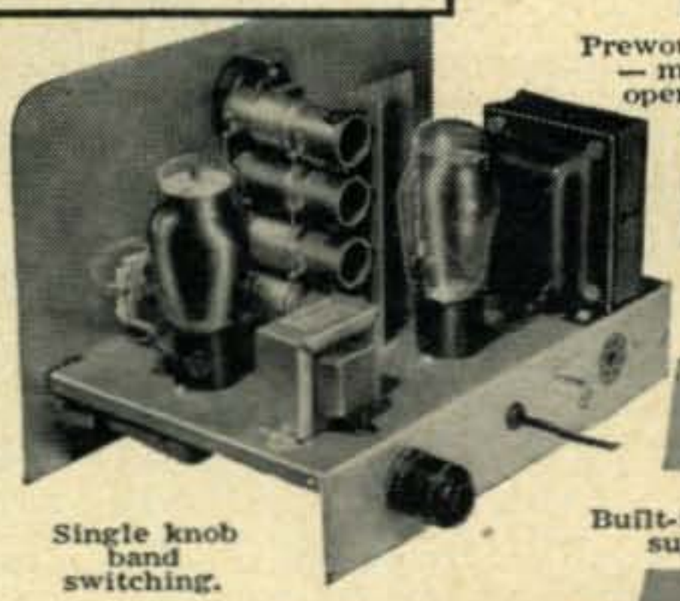
Range 80, 40, 20, 15, 11, 10 meters.
6AG7 .....Oscillator-multiplier.
6L6 .....Amplifier-doubler
5U4G ..... Rectifier.
105-125 Volt A.C. 50-60 cycles 100 watts. Size: 8⅛ inch high x 13⅛ inch wide x 7 inch deep.

Here is a major Heathkit addition to the Ham radio field, the AT-1 Transmitter Kit, incorporaring many desirable design features at the lowest possible dollar-per-watts price. Panel mounted crystal socket, stand-by switch, key click filter, A. C. line filtering, good shielding, etc. VFO or crystal excitation—up to 35 watts input. Built-in power supply provides 425 volts at 100 MA. Amazingly low kit price includes all circuit components, tubes, cabinet, punched chassis, and detailed construction manual.

Crystal or VFO excitation.

Prewound coils — metered operation.

Rugged, clean construction.



52 ohm coaxial output.

Built-in power supply.

Single knob band switching.

Heathkit COMMUNICATIONS RECEIVER KIT

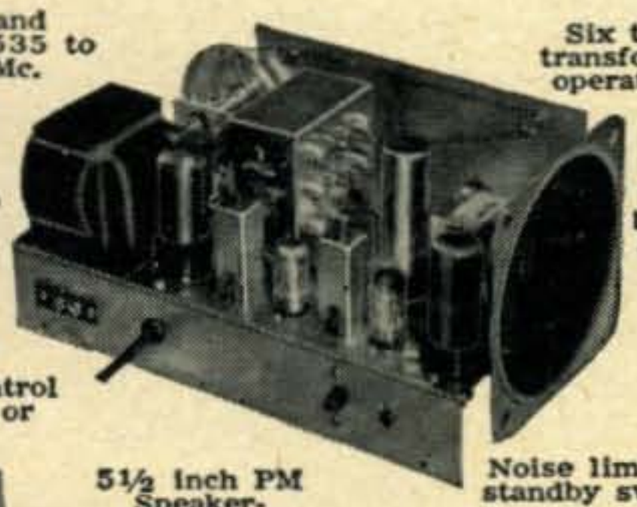
Four band operation 535 to to 35 Mc.

Six tube transformer operation.

Stable BFO oscillator circuit.

Electrical bandspread and scale.

RF gain control with AVC or MVC.



5½ inch PM Speaker-Headphone Jack.

Noise limiter—standby switch.

SPECIFICATIONS:

Range.....535 Kc to 35 Mc
12BE6 .....Mixer-oscillator
12BA6 .....I. F. Amplifier
12AV6 Detector—AVC—audio
12BA6 ....B. F. O. oscillator
12A6.....Beam power output
5Y3GT .....Rectifier
105-125 volts A. C. 50-60 cycles, 45 watts.

A new Heathkit AR-2 communications receiver. The ideal companion piece for the AT-1 Transmitter. Electrical bandspread scale for tuning and logging convenience. High gain miniature tubes and IF transformers for high sensitivity and good signal to noise ratio. Construct your own Communications Receiver at a very substantial saving. Supplied with all tubes, punched and formed sheet metal parts, speaker, circuit components, and detailed step-by-step construction manual.

MODEL AR-2

$25.50

Ship. Wt. 12 lbs.

CABINET:

Proxylin impregnated fabric covered plywood cabinet. Shipg. weight 5 lbs. Number 91-10, $4.50.

HEATH COMPANY

BENTON HARBOR 12, MICHIGAN

Feenix, Ariz.

Deer Hon. Ed:

You knowing that feller with the bow and arrow? Let me telling you, he meen feller to playing around with, buleeving me — and in case you getting confused, I not speeking of Hon. Roben Hoods. No indeedy, I speaking of that feller they calling Cuepid.

To explaneing properly are having to go back a bits. You no doubtly recalling I having XYL-to-be by name of Lil Watanabe. For past cupple yeers she being after me to getting her engagement ring to seeling compack.

Normally are being able to explaneing that are not having suffishent bux to swinging deel on Hon. Sparkler. Howsumever, this past Xmas are getting nice big fat checks from Hon. Ant Fuji. This not being to bad, except that my Hon. Brother Itchi quicklike telling Lil all about same before Scratchi can blowing money on amchoor radio equipment.

When Lil are heering about the many bux that I having, she telling me that she wants to seeing nice big dyemund ring on her finger before Valentine's Day, or else she knowing that Scratchi are rather being married to amchoor radio than to her. Wowiee!! what a predickament!

Well, Hon. Ed., the way I looking at it, everybuddy gotta go sometime. After all, just getting Lil a little old engagement ring not meening I having to marry her right away. And even when getting married, I still being able to be a radio amchoor. So, what with Brother Itchi keeping up the pressure, I deciding I better getting Lil her ring.

So, this morning telling Itchi I going shopping for Hon. Rock for Lil, stuffing money in my pockets, and taking the stayshun wagon to town. I not knowing it then, but would have been far better off if not telling Itchi what I doing.

Are returning to ranch that evening just at dinnertime. Walking in front door, and who you thinking are standing there with package in her hand, big smile all over her face, saying she just happened to be in nayburhood and dropping in?? You gessing it — Lil. Just hap-

[*Continued on page 8*]

Those white vapor trails coursing the sky tell a story of vast importance today . . . a story of power, performance, protection. The planes responsible for these modern "smoke signals" are America's guardians. Each one is a masterpiece of engineering skill . . . superbly equipped for the detection and destruction of attackers. Much of the electronic equipment in these planes . . . radar, communication and control-operation equipment . . . is made by Hallicrafters, a "primary producer" for the Armed Forces. As a pioneer in electronics, Hallicrafters has the ability, experience and production facilities necessary for such vital products.

see hear see hallicrafters

4401 West Fifth Avenue, Chicago 24, Illinois

World's largest exclusive manufacturers of communications radio

HALLICRAFTERS FACILITIES ARE NOW BEING USED FOR THE DEVELOPMENT AND PRODUCTION OF: GUIDED MISSILE CONTROL EQUIPMENT • COMMUNICATIONS EQUIPMENT • COUNTERMEASURE EQUIPMENT • COMBAT INFORMATION CENTER • HIGH FREQUENCY ELECTRONIC EQUIPMENT • MOBILE RADIO STATIONS • MOBILE RADIO TELETYPE STATIONS • PORTABLE TWO-WAY COMMUNICATIONS EQUIPMENT • RADAR RECEIVERS AND TRANSMITTERS (ALL FREQUENCIES) • RADAR EQUIPMENT

[*from page 6*]

pened to be in nayburhood my Sacred Ant Fanny — Lil are living eleventeen miles the other side of town.

So there are Lil with silly smile on face, asking me what all I have been doing all day, and there are geenyus Brother Itchi standing there trying to keep from smiling — Hon. Ed, now are reely in 1/c spot. What could I do, I telling her the trooth.

I telling her I on my way to jewelry store when just by accident are passing radio store. Scratchi are passing this store many times, and nothing happening, but, today they having red-hots fire sale — all equipment one-half off. Hon. Ed., what would any red-blooded amchoor doing? Right, and that what I doing.

When Lil heering this, her smile changing to face that looking like calm before storm. She asking me straight-out if I having brought a ring home with me. So I told her. I hadn't.

Hon. Ed., I not knowing what Lil are carrying in that package she having in hand, but when she hitting me on hed with it — well, it feeling like she having thirty-foots rotary beem in it.

As Lil are leaving the house, Hon. Brother Itchi are laffing like furies. He having so much fun that I just leeving him on the floor and I going out to car to getting radio stuff I buying.

Later on, he coming into shack and asking if I not worried about losing gal-friend Lil. I telling him no I not, on acct. I did buy her a ring. No, I didn't bring it home with me, on acct. wanting it to fit her finger, so jewelry feller are cutting it down to right size.

So, when Itchi asking me if I not going to calling her and explaneing hole thing, I telling him no. I telling him I thinking that maybe she finding out that I having a ring in the same way she finding out that I are out shopping for one today.

Evidentally Itchi getting idea, as just now he hedding in direcshun of tellyfone. Hah!! Outside of radio, three fastest methods of communicayshun are tellygraf, tellyfone and telling Hon. Brother Itchi.

I letting you know when Lil come crawling back. Let Cupid shoot a cupple arrows in her direckshun.

Respectively yours,
Hashafisti Scratchi

WOW!

You casting eyes on CQ World Globe yet?
(see page 97)

. . . de W2NSD

NEVER SAY DIE

Read The Editorial, For a Change

This issue of *CQ* rounds out a full year for me as editor. Last February's *CQ* carried an introductory note about me and a cut of my QSL card.

Nine out of ten people I talk to on the air don't have any idea who the editor of *CQ* is. Mail still comes addressed to past editors of the magazine whose office portraits are yellowed with age.

W2NSD/KV4

Jim (K2OLK, our assistant editor) and I have been getting around quite a bit of late and much of interest has transpired. How many people go away to a weekend resort in the Berkshires and set up a Gonset Communicator, Linear Amplifier, and six-element rotary beam in their room? That, together with the horseback riding, ping pong, eating, dancing, etc., sure kept us busy. Several QSO's were made up into the Albany-Schenectady area and over into central Massachusetts.

Our main excursion was a one-week jaunt down to visit Dick Spenceley, KV4AA, Exalted DX Editor of *CQ*. Amazing, the round trip plane ticket to St. Thomas is less than $150. What a difference that seven-hour plane ride makes! From bitter cold New York we arrived in the tropical Virgin Islands, shedding coats, wool shirts, and gloves as we stepped off the plane. 80° there, with nights as cold as 70°, br-r-r-r-. . .

We stayed a week and had a wonderful time. If you get close to Brooklyn you may get trapped into a complete show of my Kodachromes of the trip, so beware. The native mangos, papayas, jelly-nuts, sugar apples, bananas, sour-sops, and other fruits were so plentiful and delicious that I feared Jim would decide to stay permanently.

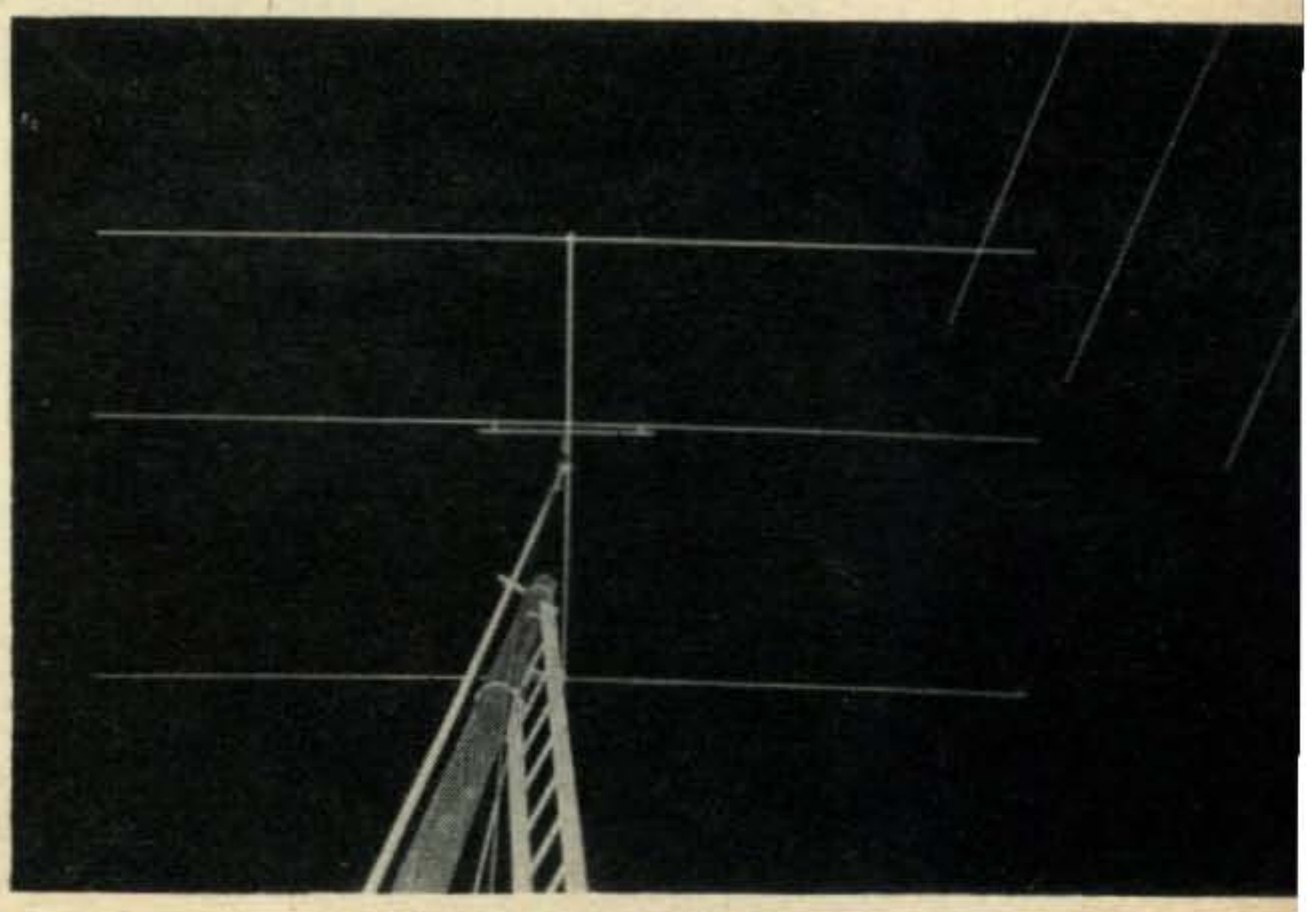
Armed with Aqua-lungs rented from M. Caron, father of Leslie Caron, we went skin diving around the coral and saw several pretty good sized fish. This was a lot like swimming in a large aquarium, for there are fish all around you, but few of them paid much attention to the intrusion (thank heavens). We did see a large turtle zipping by at express-train speed and had the thrill of seeing a good sized Manta Ray go within 15′ of us heading for a large school of smaller fish.

I located an ex-racehorse and had some good

Traipsing down to the Virgin Islands, we captured this rare shot of DX Editor Dick Spenceley

riding along the beach and through the coconut groves. Most of the island is undeveloped and houses are few and far between. I would say that St. Thomas qualifies in about every way as a tropical island paradise.

And ham radio. . . . Wow! From down there you hear almost the entire United States all day long. There are only a few stations in the Virgin Islands so for most operators you easily pass as a DX station and are accorded certain courtesies (or discourtesies, as the case may be). As a hardened phone man I was quite



and his 15-meter beam (see text)

astounded to watch Dick knock off a half dozen c-w QSO's in as many minutes. I tried my hand during some lulls in Dick's heavy operating schedule and got a small taste of being DX. This is definitely catching. Shortly after getting this mainline kick I sat down and talked DXpeditions with Dick. Might be we could work something up for this spring where we would get together with Dick and a couple of others and stagger ashore on some practically uncharted island and achieve momentary notoriety. Who wants to go?

Our thanks to Dick and his wife Anna for putting up with us for the week. They were wonderful and we shall always remember our trip with pleasure.

On our return we stopped for a day at Puerto Rico and were met at the airport by Brad, KP4TF, and Beverly, KP4YX. Beverly and her OM George, KP4YW, served a wonderful dinner. Later we had a hamfest with KP4AAO, W2FME, and W6CIW/KP4 visiting. Brad went way out of his way to make

NSD gulping coconut milk

our short stay enjoyable by driving us all around San Juan and showing us the landmarks, putting us up overnight, and finally driving us back out to the airport to catch our plane back to New York. We visited KP4KD, who did such a splendid job in the DX Contest, and found that he will be off the air until he moves to a new location. This will probably keep him off for the ARRL DX Contest and give some other KP4 a chance to win a DX Contest for a change. KP4WN will soon be moving to St. Croix and should be on the air from there as a KV4.

Beam Pictures

It is hard to get good pictures of beams. While wandering around St. Thomas with my Retina IIIc, looking for something to photograph, I got the idea of taking a flash picture of the KV4AA arrays at night. As you can see, this worked out fine. The beam stands out clearly against the black sky and the detail is good.

Articles Wanted

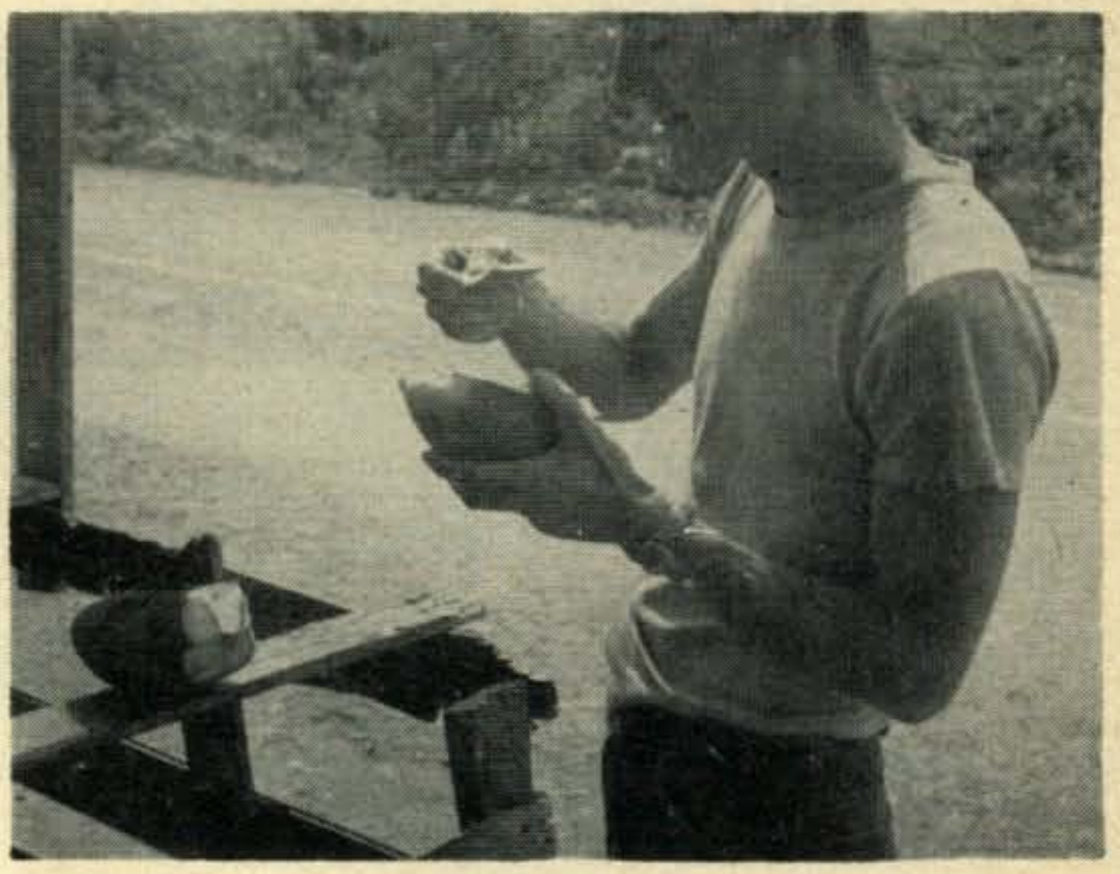
As you may have discerned, my plea for more and better articles has not been spurned. The first of three articles on Printed Circuits, starting in this issue, is a bit different from the things we have been running, but I hope you

Bill, W6CIW/KP4 Bill, W2FME

will take it in your stride and ask for more. Somehow I get the feeling every now and then that ham radio is moving much too slowly. Here we are with all sorts of possibilities before us and what do we do? We go on the air with essentially the same eqjuipment we were using twenty years ago and talk about the same things we did twenty years ago in the same ways we did twenty years ago.

What kind of nonsense is this? All of us could easily improve things considerably if we wanted to. How come only the SSB gang have

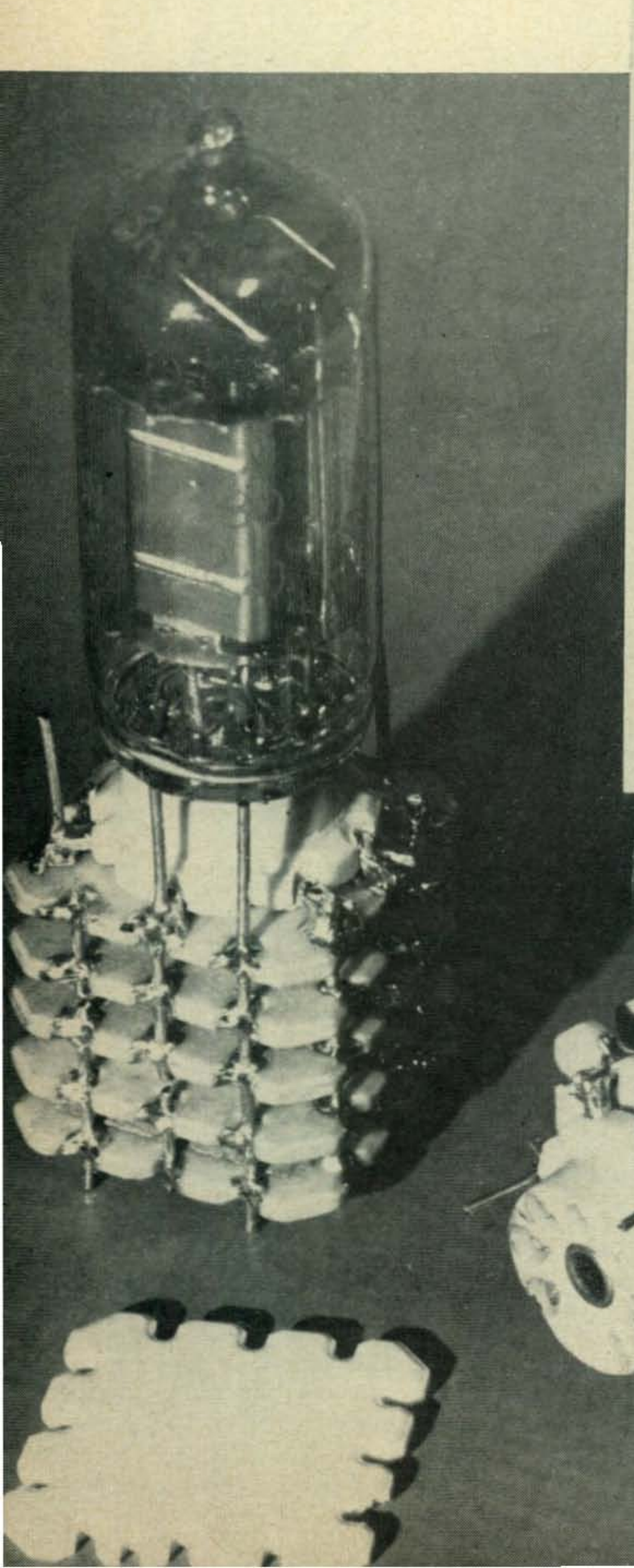
Jim scooping out meat from green coconut



the luxury of voice-control operation? Ridiculous. How come so few use our AØ bands such as 11-6-2, etc., for duplex operation? Duplex, for those that are not familiar with it, is (like on the telephone) where you use separate antennas for transmitting and receiving and use both simultaneously so you can talk back and

[*Continued on page 117*]

Fig. 3. Modular design "Tinker Toy" units containing printed components. Several such unitized circuits are mounted on an etched circuit board. Photo courtesy NBS.



Printed Circuits and the Amateur

—PART I

WHAT ARE THEY?

With printed circuits being used more and more in commercial and military equipment, their application to amateur equipment and home construction techniques can be evaluated with reasonable expectation of interesting if not profitable results. It is recognized that the employment of so-called printed circuits in equipment subject to amateur use is not new[1], neither is it widespread. Likewise, kits have been advertised[2] for "make-your-own printed circuits". Nevertheless, the dearth of information in amateur publications on practical applications and techniques for printed circuits has been apparent, and it is to that end that these articles are devoted.

Circuit Boards

"Printed circuits", as a generic term, has been applied to a wide variety of processes for electronic circuit and component manufacture. However, that process which has enjoyed greatest recent acceptance is, in the true sense, not a "printed circuit" but rather "etched wiring". It consists of a 1/16th inch thick phenolic resin impregnated paper base panel, to one or two sides of which has been bonded a copper foil of about 1/1000th inch thickness. Etching is introduced as the means for removing unwanted copper foil in certain areas, leaving strips of wiring to which conventional tube sockets, resistors and condensers may be soldered.

This method, although more widely used, is one of many currently investigated by science and industry in an effort to develop a simple and efficient method of producing a planar insulated board or chassis complete with all circuit wiring upon which conventional electronic components can be assembled manually or automatically and subsequently mass soldered. Figure 1 illustrates an etched circuit and the same board complete with components as viewed from the other side.

Capsulated Composite Components

Somewhat hidden by the voluminous publicity given other quasi-printed circuits, are their own parental predecessors. As early as the 1920's, several components such as transformers and condensers were "potted" in an integral package and used in B battery eliminators. True, there were no printed circuits in that assemblage, but the principle involved in capsulating composite components was, for example, the forerunner of the VT fuse, the largest single boost to printed circuits. Experience thus gained accelerated the practical development for commercial application of complete passive networks. These networks consisted of resistors, capacitors and inductors whose manufacture on flat dielectric media exemplify true "printed circuits". Perhaps the best known examples of capsulated composite components are the P. E. C. Units[3] known as "Couplates", "Audets", "Filpecs" etc. Practically all broadcast radios and television sets made today employ one or more of these printed electronic circuits and their dependability and low cost have caused their use to be taken for granted. Figure 2 shows an interstage coupling network of remarkably small size when compared with the conventional components it replaces.

Modular Design and Mechanical Production

Labor costs and the mounting demand for electronic components and assemblies have placed increasing emphasis on automatic pro-

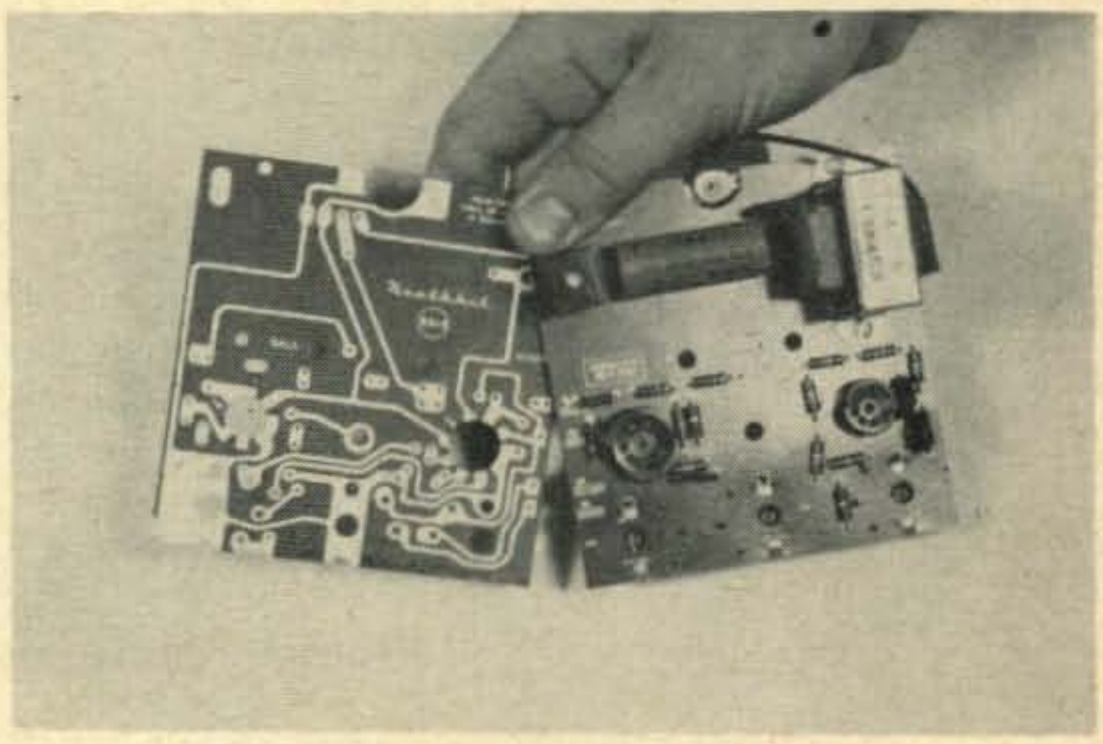
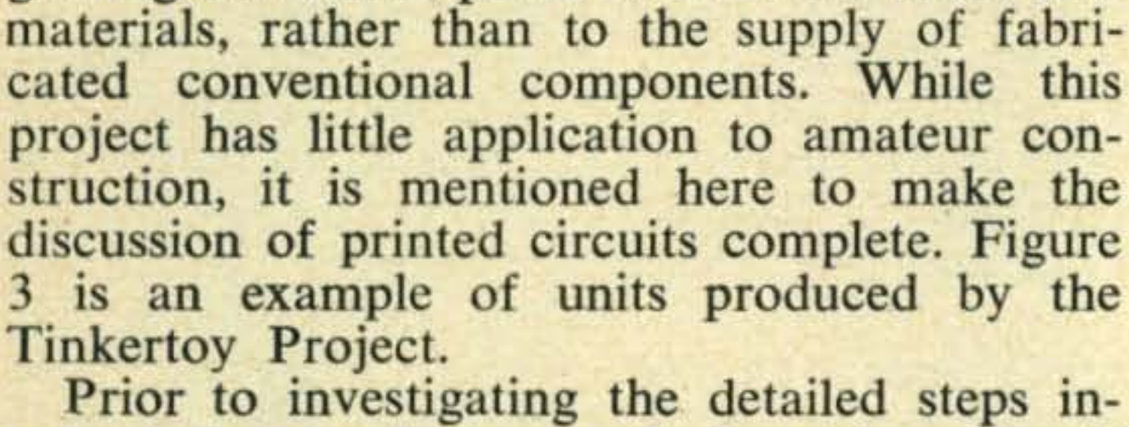


Fig. 1. Example of commercially available etched circuit boards in kit form. Courtesy Heath Company, Benton Harbor, Michigan.

duction methods. Indeed, any electronic manufacturing process contemplated today must of necessity be adaptable to automation, and to be so, must first be of uniform and reproductible size and design. One approach to this end is the now famous "Tinkertoy Project" which was undertaken by the Navy and the Bureau of Standards. Using both etched circuit boards and composite components printed on uniform size ceramic wafers, this project sought to gain independence from wartime bottlenecks by gearing automatic production to the basic raw materials, rather than to the supply of fabricated conventional components. While this project has little application to amateur construction, it is mentioned here to make the discussion of printed circuits complete. Figure 3 is an example of units produced by the Tinkertoy Project.

Prior to investigating the detailed steps involved in producing etched wiring circuit boards, it would be informative to briefly review the background of printed circuit applications. The history of the modern printed circuit concept is shown in Figure 4. No attempt has been made to establish the earliest date on which the various processes were conceived, but instead, attention is focused on the approximate date public recognition was given to specific applications.



Centralab's "Audet"®

Fig. 2. Capsulated interstage coupling network, showing circuit in which used and eight individual components it replaces. Courtesy Centralab Div. of Globe Union, Inc.

ADVANTAGES AND DISADVANTAGES

The first and compelling advantage offered by printed circuits is the saving in labor normally required to assemble and solder the components into a circuit. While such savings are significant and of vital concern to industry, the following secondary or indirect features are of greater interest to the amateur constructor:

1. *Simplicity*, thru elimination of chassis, tie points, hook-up wire and mounting hardware.
2. *Accessibility* of all components for servicing.
3. *Rigidity*, due to each component being mounted directly to the panel with minimum length leads resulting in ruggedness and operating efficiency.
4. *Compactness* inherent in the functional orientation and placement of parts, leading to further ability to "unitize".
5. *Accuracy*, thru virtual elimination of "human error". Minimum testing and checking.
6. *Uniformity* between units when making more than one unit, thereby minimizing unpredictable stray capacities.

Notwithstanding this bold array of advantages, it must be conceded that present day usage of printed circuits presents certain disadvantages. These disadvantages, thru a proper understanding, may be "licked" to a greater or lesser degree:

1. *Separation* of the foil from the phenolic. Protection of the original bond strength may be achieved by avoiding excess soldering temperatures and durations, by using fine toothed cutting saws and by designing the placement of parts so that movements due to subsequent accelerations will not be transmitted to the foil.
2. *Burning* of the phenolic can be minimized by using a small soldering iron when local hand assembling is done.
3. *Removal of parts* for repair or replacement requires use of techniques new to servicemen. In general, excess solder is carefully removed with a fine wire brush after the joint is heated. The component leads are then bent straight, if necessary, so that removal of one or both ends from the panel may be done without disturbing adjacent components or foil. Detailed instructions for service work have been compiled.[4]

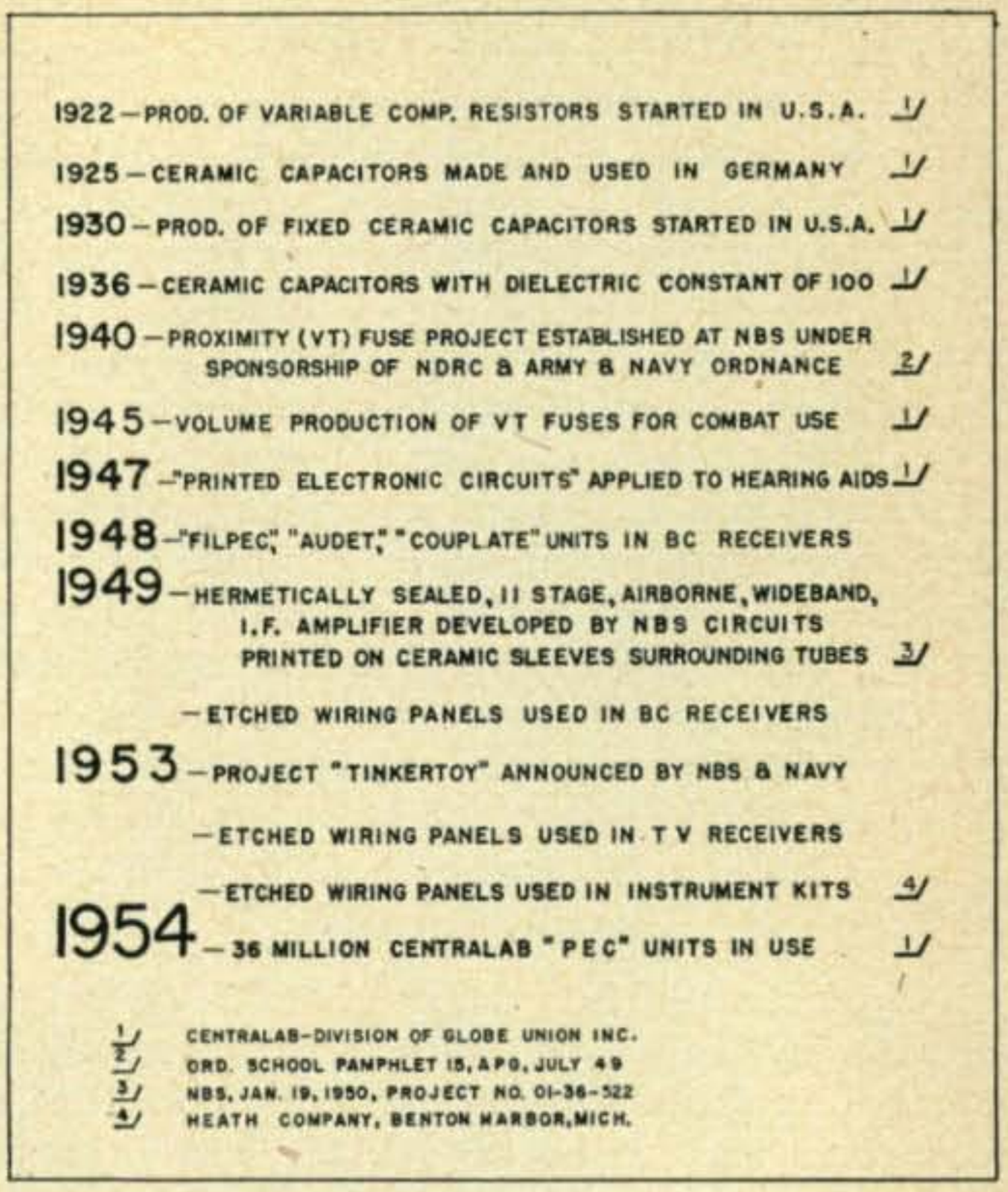


Fig. 4. History of modern printed circuit concept.

1. Oscilloscope & VTVM Heathkits.
2. Keil Engineering Products (KEPRO), and Tele-Diagnosis Co., etc.
3. Centralab Division of Globe Union, Inc.
4. Admiral Corporation Service Manual No. S559.

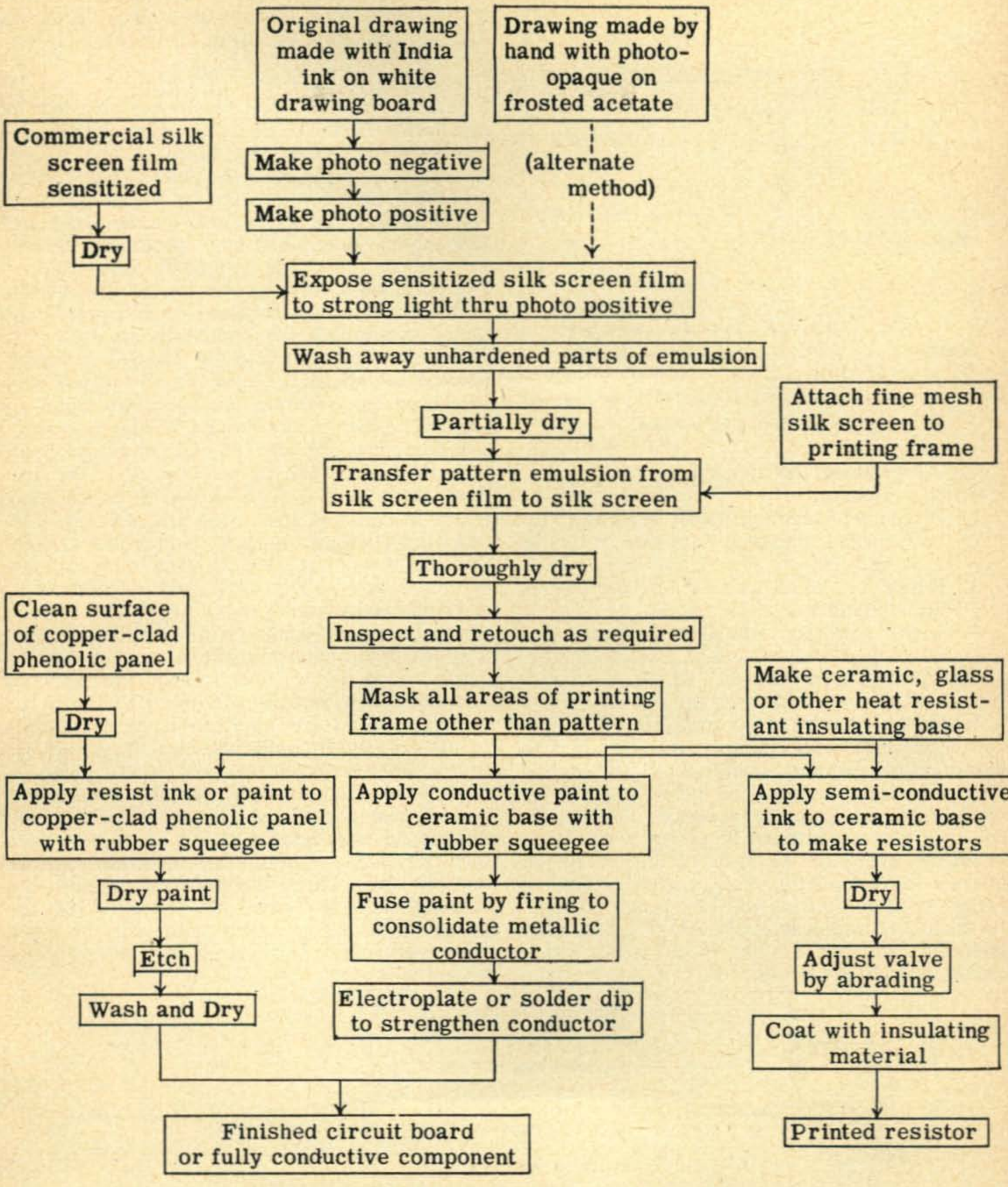


Fig. 5. Silk screen method for producing printed circuits and components.

PRODUCING PRINTED CIRCUITS

Methods of producing printed circuits are considerably varied, with each method possessing its own relative merits. Basically, those varied methods can be reduced to two fundamental processes. In the first, the conductor, or the material which is later to become or support the conductor, is *applied* to an insulating base in the pattern of the desired circuit. Examples of this process are:

1. Silver paint, silk screened on ceramic
2. Conductive ink, offset printed on an insulating base
3. Copper foil, die stamped or "dinked" and attached to a phenolic base
4. Metal, sprayed thru stencil onto an insulating base
5. Graphited pattern, built up by electroplating

The second general category provides for the *removal* of conductive material in designated areas from a uniformly coated insulating base

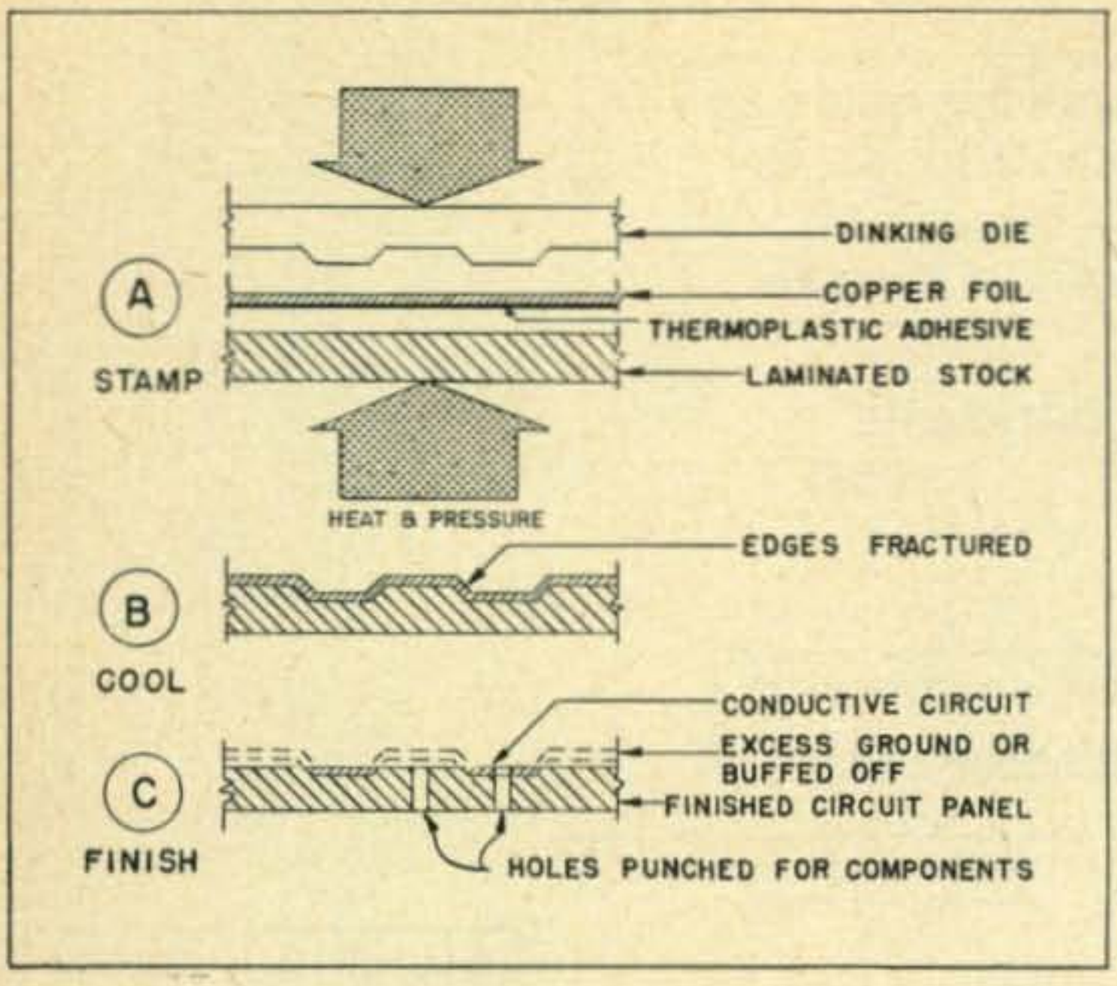


Fig. 6. Die Stamping method.

so as to produce the desired circuit pattern. Examples include:

1. Protective enamel, silk screened on copper-clad phenolic laminate prior to etching
2. Resist ink, offset printed on laminate as an etchant resist
3. Light sensitive emulsion exposed and developed on laminate as a resist
4. Electroplated deposit which forms a selective etchant resist on laminate

In practice, one or more combinations of the above processes and examples may be used to manufacture printed components or etched circuit boards. It must be noted that if an integral resistor is to be produced, a partially conductive material must be added in the form of an ink or a strip which is pasted on. In the interest of simplicity, only fully conductive components and wiring will be considered here. In so doing, emphasis is placed on copper-clad phenolic laminate as the stock from which circuit boards are produced. This approach is desirable due to current increased use of this technique in actual equipment and the promise it holds for adaption to amateur construction.

Silk Screen Method

Silk screen stencils or masks are prepared in the normal manner used by commercial illustrators, except that the finest weave silk is chosen and preference is given to a photographic system for transferring the image from a master drawing to the silk screen. Once the silk screen stencil has been prepared, it may be used to control the application of a conductive paint on a ceramic base or the application of an etchant resist enamel on a copper-clad phenolic laminate. Conductive paints used with silk screen stencils usually have a metallic silver base which is subsequently fused and tinned so as to obtain the necessary build-up for conductivity and strength. Partially conductive materials are also applied in liquid form thru the silk screen to produce resistors. The flow chart in Figure 5 shows essential steps taken in making and using silk screens. Detailed instructions on their application to electronics on a laboratory scale as well as a list of materials suppliers have been assembled.[5]

Principal advantages of the silk screen method are that it allows direct application of a conductive media and the stencil or mask is easily made using well known graphic arts techniques. Although this method finds its greatest use in the application of conductive paints for wiring and resistors, it is equally useful in the application of resist enamels, identification numbers, assembly instructions and trademarks to the circuit board. Its disadvantages are relative lower accuracy than that obtainable from other methods such as the photoengraving method, susceptibility to clogging of the screen or smearing of the paint, high cost of silver paint and the extra manufacturing step required in firing and tinning the silver.

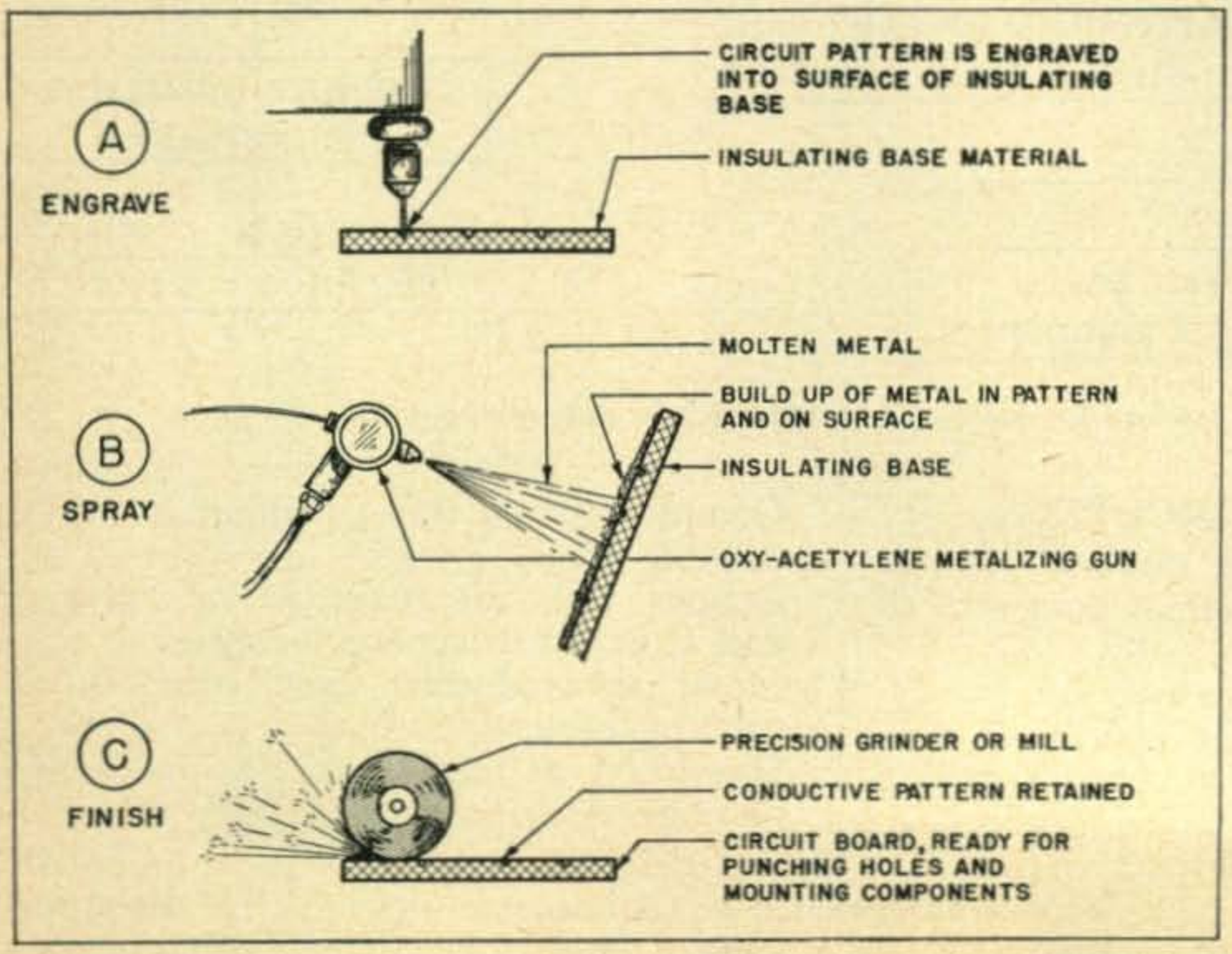


Fig. 7. Metalizing method.

5. Technical Memorandum No. M-1413 "Photographic Silk Screen Process in the Fabrication of Printed Electronic Circuits" 17 Oct 1951, SCEL, Ft. Monmouth, N. J.

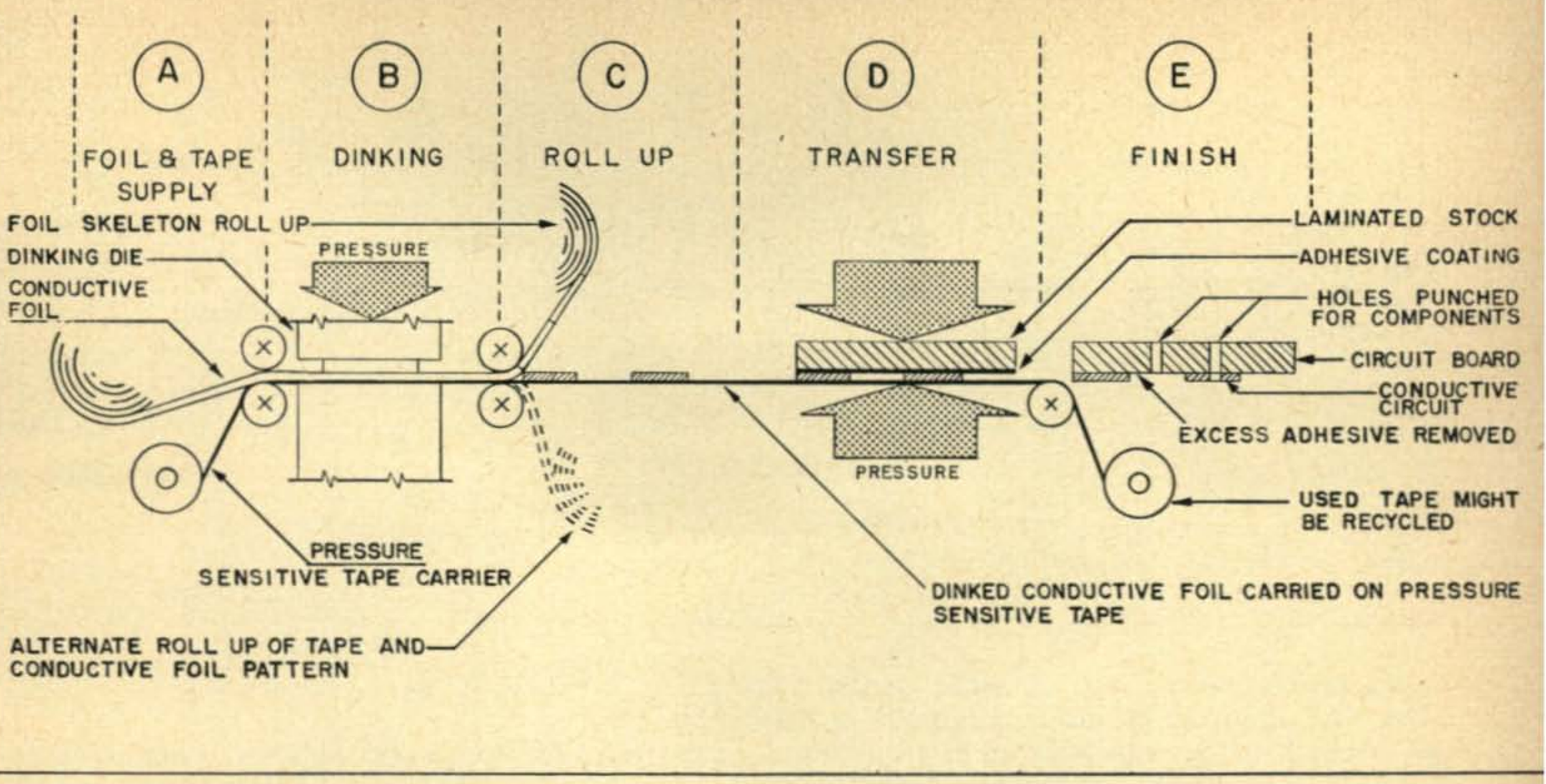


Fig. 8. Tape Transfer method.

Mechanical Methods

Use of the mechanical methods shown in Figures 6 and 7 has been somewhat limited due to the cost of the stamping or "dinking" dies. However, due to the greater thickness of conducting material usually present when using one of the mechanical methods, the latter are particularly valuable for factory production of contacts, sliding switches, commutators etc. In Figure 6, it can be seen that a conductive pattern is stamped from metal foil or sheet, and simultaneously bonded to or pressed into the surface of the insulating material. In a variation of this method, a recessed pattern is machined, engraved or otherwise sunk into the insulating base. Figure 7 shows how liquid metal is then sprayed into the recess and the surface finished according to end use to which the panel is to be put.

Other variations in the mechanical production of circuit boards include the tape transfer method in Figure 8 and the platen transfer method in Figure 9. Both provide for the transfer of a predefined wiring pattern to an insulating base as does the double foil method in Figure 10. The difference exists in the actual manner of producing the pattern in the foil.

Electroplating Methods

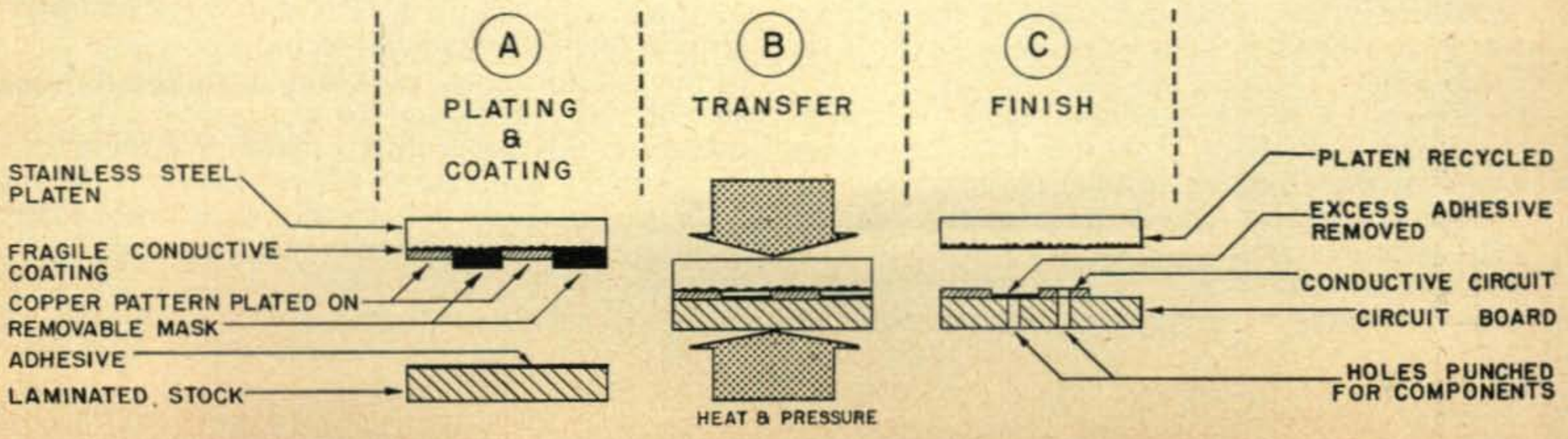
Electroplating is used on copper-clad phenolic laminates as a resist in the subsequent etching of the copper foil. See Figure 11A. To begin with, a non-conductive pattern is applied to the copper-foil surface by silk screening, offset printing, or photoengraving, etc. This pattern resists the electroplating action of silver, nickel or rhodium on all but the actual areas where the wiring is to appear. A plating metal is chosen which will not be affected by the etchant used in the removal of copper foil. Prior to etching, the resist pattern is removed by a suitable chemical, exposing the copper to the etchant. When a bright electroplated metal such as nickel is used, it serves the additional purpose of protecting the copper surface from oxidation which would discolor the finished circuit board and hinder soldering.

A deviation is employed when applying a conducting circuit to an insulating panel not having the copper foil as in Figure 11B, or when making plated through connections as in Figure 11C. Under these conditions, a colloidal suspension of graphite[6] is applied on the areas to be plated. When dry, the graphited surface is plated-over with copper or silver to make a durable conductor.

Electroplating has, in practice, been limited to applications where its unique characteristics are essential, such as in plated through-connections and in producing a bright appearing conductor of good customer acceptance. With the perfection of the copper-clad laminates and

6. such as "Aquadag"

Fig. 9. Platen Transfer method.



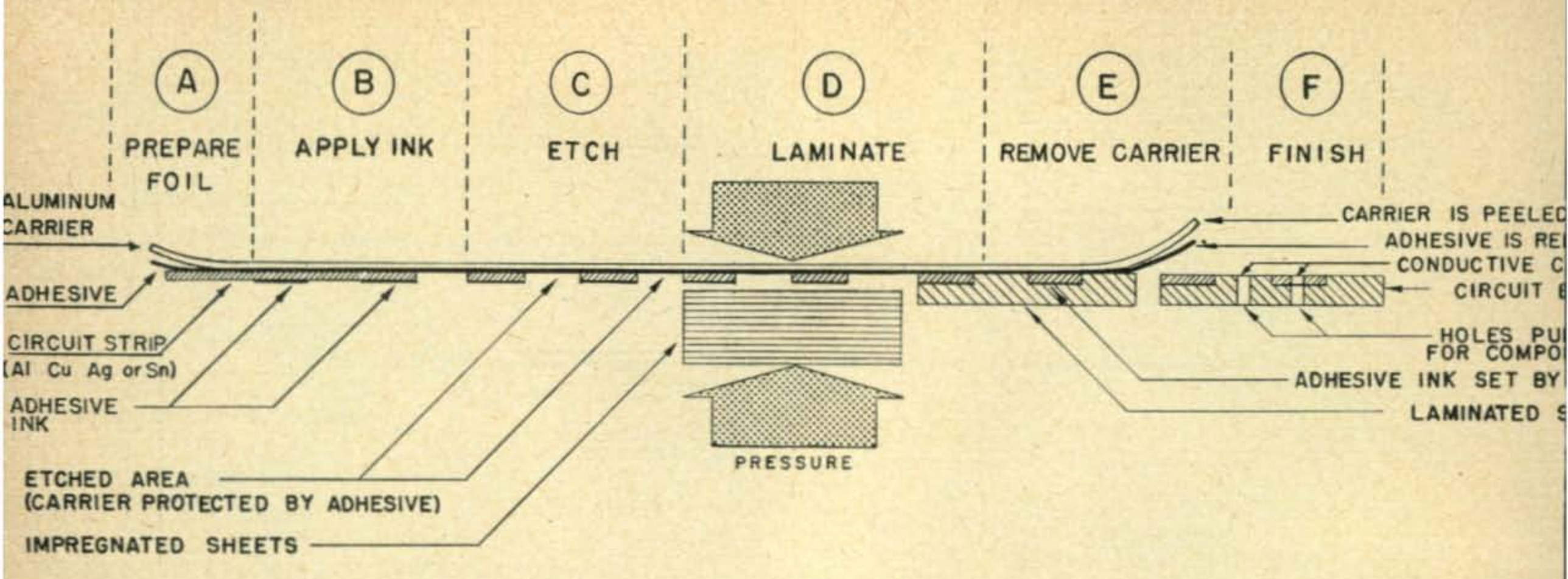


Fig. 10. Double Foil method.

upon proper circuit layout, little occasion is found for the electro-plating technique in mass production, for it represents an extra manufacturing step which can reasonably be eliminated. Also, present day dip-soldering provides the conductor "build-up" and bright appearance which were sometimes obtained by plating.

Offset Printing Method

Apparently the simplest, yet least adaptable to amateur construction techniques, is the offset printing method shown in Figure 12. Assuming the pattern has been printed on the copper-clad laminate with acid resisting ink by some suitable means (as simple as being drawn by hand or applied with a rubber stamp) then all that remains is to harden the ink and etch away the unprotected copper foil. In practice, the ink is not completely dependable as an acid resist, and it sometimes becomes necessary to strengthen it with a layer of asphalt powder sprinkled on while the ink is still wet. Fusion of the asphalt powder is done with heat. Application of the circuit pattern to the laminate is accomplished by an offset printing press in large production runs, and the offset printing plates are prepared from the original drawing or negative by photographic means. Ink picked up by the printing plate from the inking roller is transferred to a rubber blanket, thence to the copper-clad sheets.

Advantages of this method are speed and high production. Accuracy is somewhat less than with the photoengraving method.

Photoengraving Method

Perhaps the most widely used and most adaptable to amateur fabrication is the photoengraving method of producing printed circuits. It is briefly described here, and is the subject of a step-by-step discussion to follow in a later article.

Figure 13 shows the basic steps involved. As in other methods, a master drawing is prepared of the circuit, and then photographed to furnish a negative. The surface of the copper-clad phenolic laminate, having been thoroughly cleaned and uniformly coated with a photosensitive emulsion, is dried and exposed through the negative to an arc light or other suitable high intensity white light source. Hardening of the emulsion occurs in the presence of the light making it water insoluble, while background areas protected by opaque portion of the negative remain unchanged.

This exposure is followed by a developing treatment, (depending upon type of sensitizing emulsion) and the soluble unexposed areas washed away with water. Thus, a resist pattern is produced to protect the copper foil in selected areas during subsequent etching.

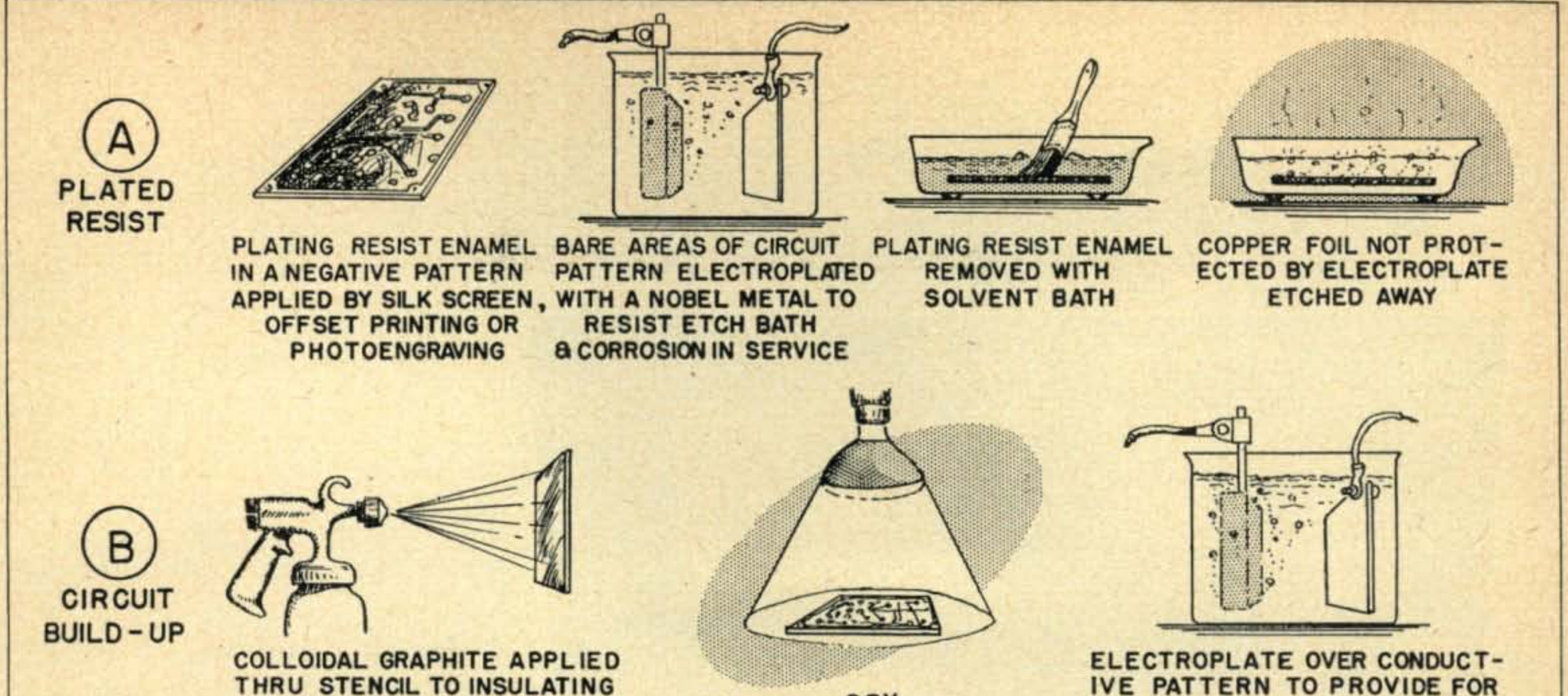
Etching is usually accomplished with nitric acid or ferric chloride, the latter being preferred due to less handling danger and ionic contamination of the insulating base. However, an electrolytic etch (opposite of electroplating) could be employed using a simple salt solution and a source of direct current such as an automobile battery. It must be kept in mind that an electrolytic etch requires continuity of circuit pattern. This has prevented its use when isolated or otherwise unjoined areas of foil are required on the circuit board.

FABRICATION OF ETCHED CIRCUIT BOARDS

Cutting and Drilling

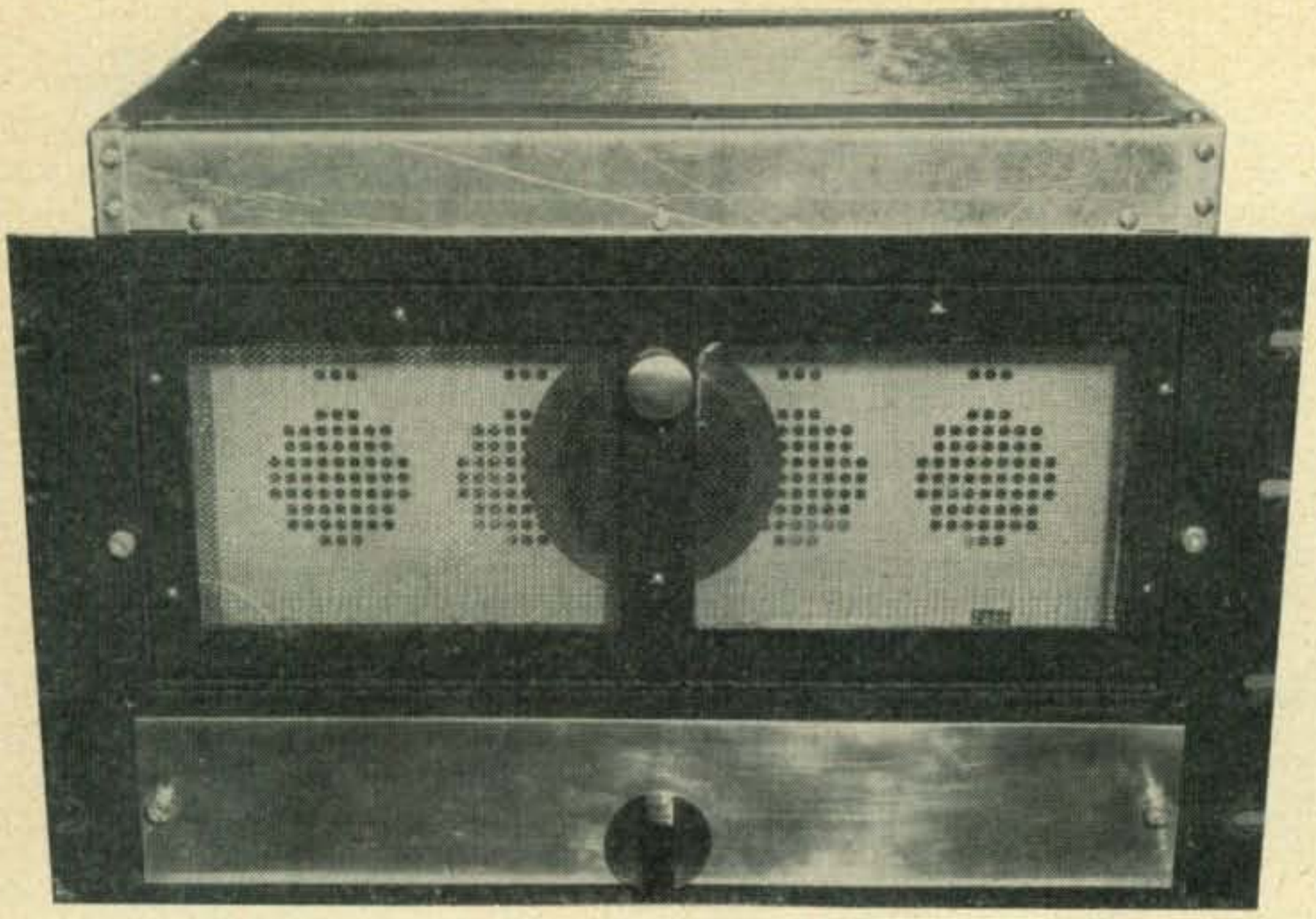
Copper-clad circuit boards, after being etched and thoroughly washed are bathed in a solvent to remove the light hardened emulsion. They are then rinsed, dried, and drilled or punched for the mounting of sockets, components and hardware. In commercial practice, where the production quantity so justifies, all holes are punched simultaneously on a standard production punch press. The use of close fitting stripper plates is essential to prevent any lifting of the foil during the punching operation. Drills should also be ground to a negative rake to minimize this separating action. Warming of the phenolic laminate to approximately 250° F prior to punching or shearing is also done to facilitate these operations and to lengthen tool life.

[*Continued on page 122*]



▲ Fig. 11. Electroplating applied to circuit boards.

▼ Fig. 12. Offset printing to produce printed circuits.



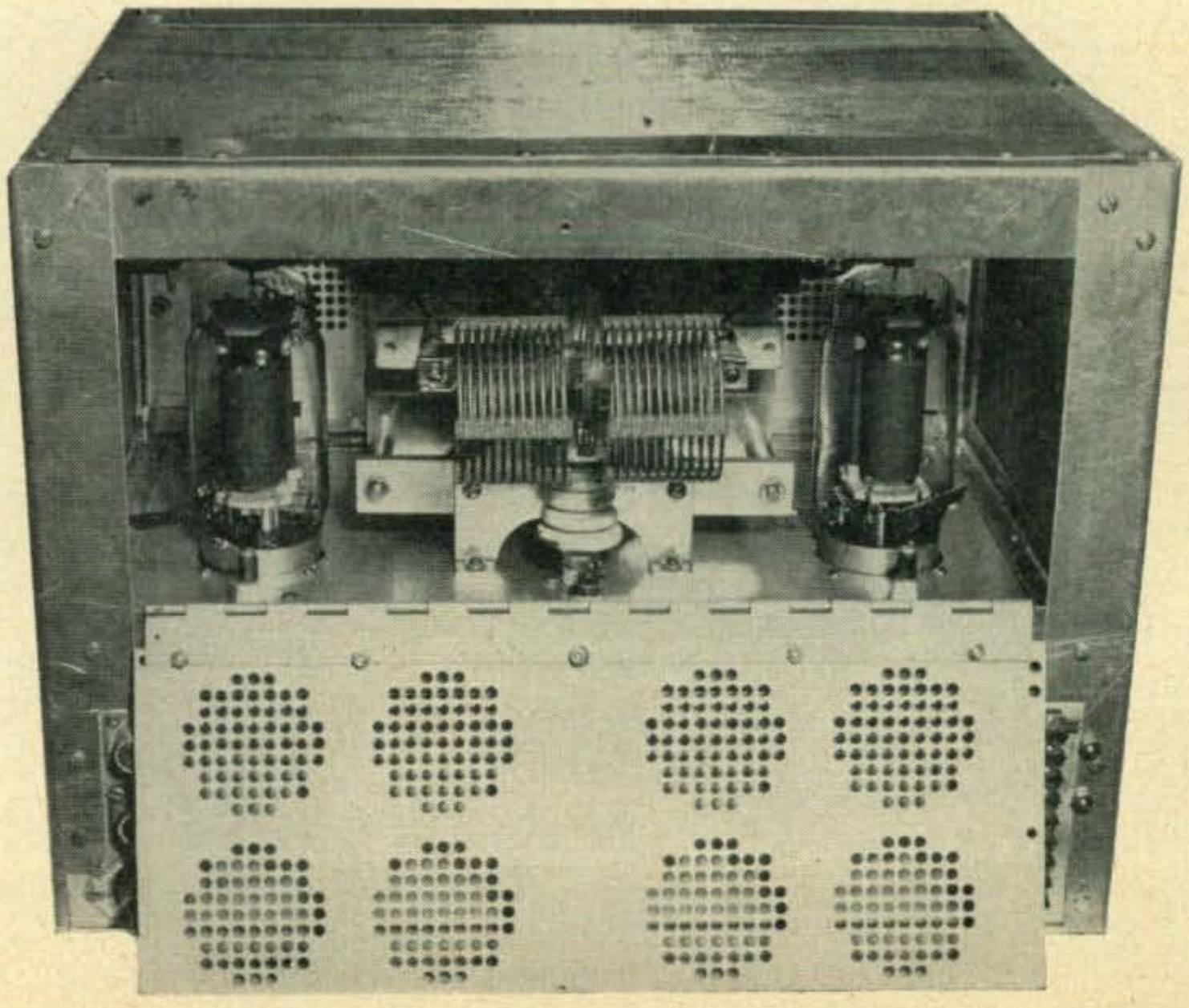
Frank Caulkins, W8NYP
R. D. 1, Box 199A, Clinton, Ohio

600-watt Push-Pull 813's

After fussing and fuming over the problem of harmonic radiation from a high power final amplifier, the staff here at W8NYP (me) launched a project the goal of which was to be an easily band-hopped pair of 813's with minimum TVI. We (more comfortable than saying *I*) hardly dared dream of the goal of *zero* TVI which tests on the finished unit now indicate. We shall wisely refrain from a blow-by-blow rehash of the saga of Cerebration which gave birth to this exact circuit. Sufficient fanfare is the report of continuous trouble-free use on 10, 20, 40 and 80 for yea these many months (a couple of years' worth).

The Circuit

The circuit is conventional with few exceptions and is shown in *Figure 1*. A *National MB-40L* is used in the grid circuit. For the plate tank circuit the *B & W* Swinging Link and 500-watt Series coils are employed. Plate tank condenser *C7* is a *B & W* butterfly condenser, model *CX45B*. Neutralization of the amplifier is accomplished by 1½" lengths of heavy copper wire mounted on feed-thru insulators near each tube. The particular physical arrangement used has proved very satisfactory and re-neutralization with band-changing is unnecessary.



During phone operation the screen grids "float". A small audio choke is employed in each screen lead. High frequency parasitics in the screen circuit are squelched by the 33-ohm 2-watt carbon resistors soldered directly to the tube socket terminals.

A small 140 $\mu\mu$fd receiving-type condenser *C-21* is inserted between the link output and the coaxial cable. Its function is for tuning out possible reactance of the antenna or transmission line. The end of one plate of the condenser is bent inward in such a manner as to provide a short circuit when the plates are fully meshed.

The usual precautions have been taken to filter all leads entering or leaving the chassis. The amplifier incorporates a built-in low-pass filter network in the r-f output. Its high frequency cut-off is approximately 40 Mc. The theoretical attenuation above this frequency is of the order of 70 db.

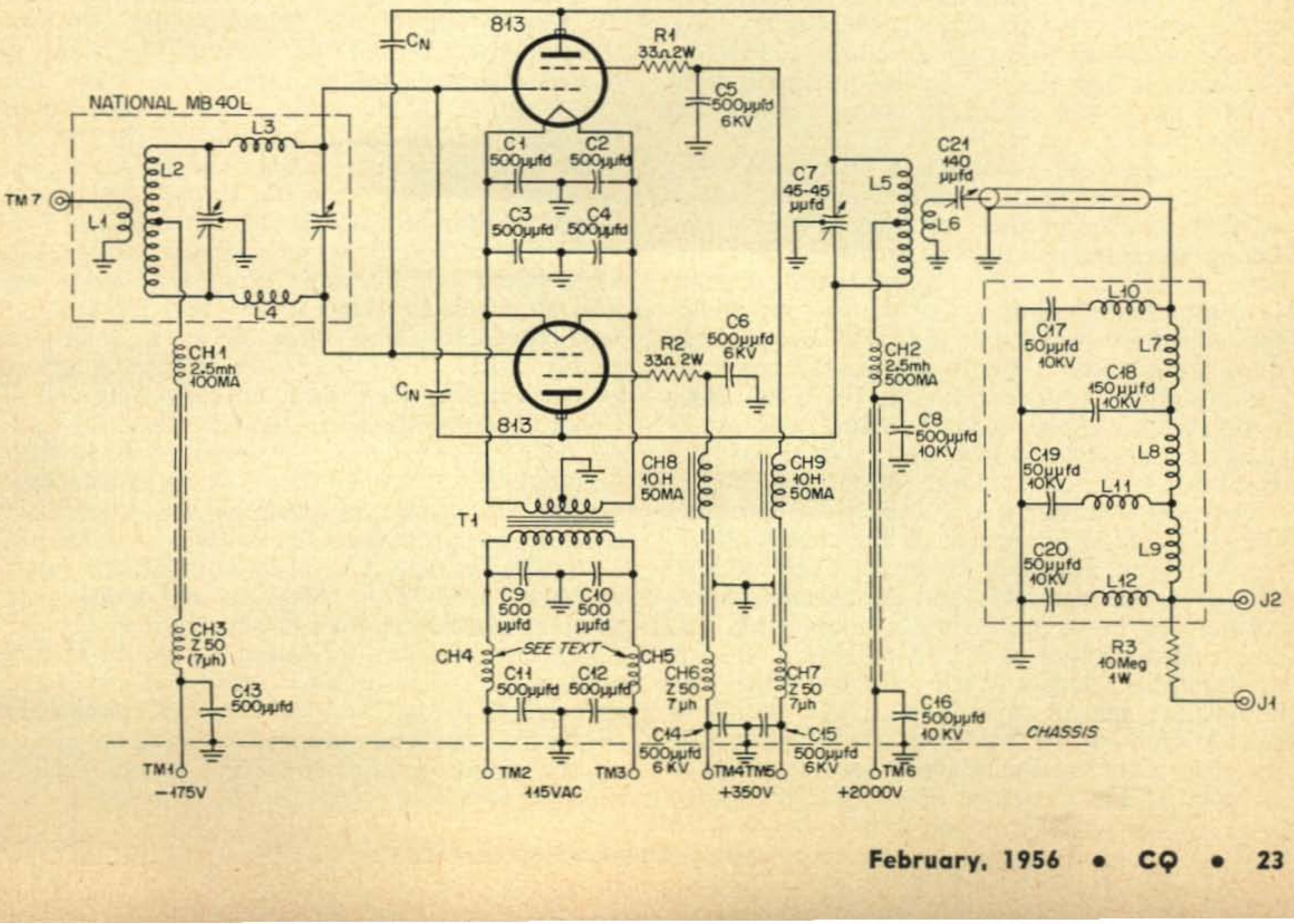
A ten-megohm resistor connected to the link output is included to provide r-f excitation for a monitor oscilloscope and phone monitor. A separate coaxial chassis fitting is provided for this output.

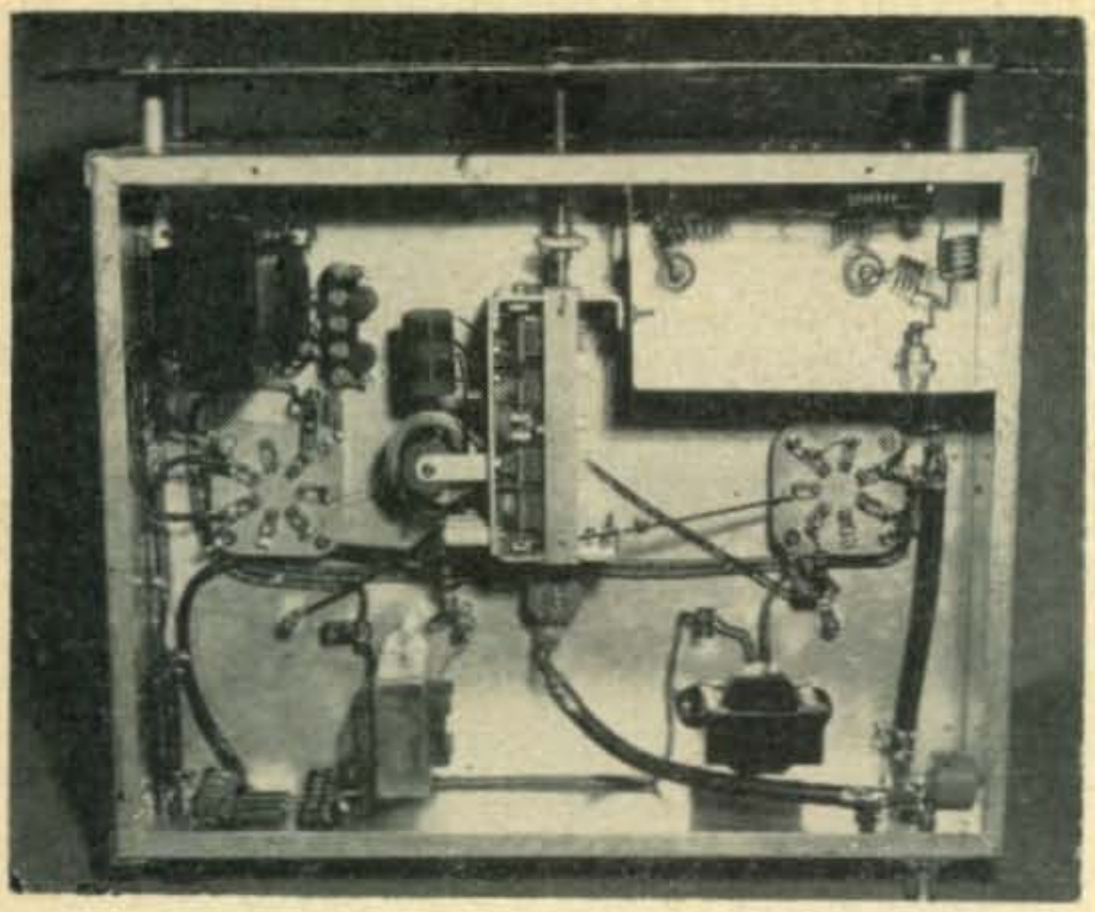
Construction

A 13 x 17 x 4" aluminum chassis is used as the base for the shielding structure which is fabricated from aluminum angle, perforated aluminum sheet and bronze screening. The aluminum angles were formed from strips of .051 S-O aluminum. If a metal breaking machine is not accessible a satisfactory substitute can be used consisting of angle-iron jaw extensions for a large vice and the hammer method of bending the metal. If the latter is used a piece of wood should be placed between the metal and the blows from the hammer to prevent marring the aluminum stock. In some instances it may be possible to purchase aluminum extrusion angle for the enclosure frame.

The enclosure frame is formed by placing vertical and horizontal angles together in a box-like construction. The vertical angles measure ¾" x 1⅝" x 12½" long, and are allowed to extend down outside the chassis, flush with the bottom, and are secured with self-tapping metal screws to the chassis. Be sure that the wide dimensions of the angle are run parallel with the

C-1, C-2, C-3, C4, C-9, C-10, C-11, C-12, C-13, C-22: 500 uufd., 600 v., disc ceramic
C-5, C-6, C-14, C-15: 500 uufd, 6000v. disc ceramic
C-8, C-16: 500 uuf., 10kv.
C-7: 45 uuf. per section split stator B&W CX45B
C-21: 140 uuf. variable, receiving type.
C-17, C19, C-20: 50 uuf. TV type, 10kv.
C-18: 150 uuf. (three 50 uuf TV type, 10kv. paralleled)
Ch-1: 2.5 mh. r.f. choke, 100 ma.
Ch-2: 2.5 mh. r.f. choke 500 ma.
Ch-3, Ch-6, Ch-7: Ohmite Z-50, 7uh.
Ch-4, Ch-5: see text.
Ch-8, Ch-9: 10 hy. audio chokes rated at minimum of 50 ma.
J-1, J-2, J-3: Chassis Coaxial connectors
L-1, L-2, L-3, L-4: National MB-40L
L-5, L-6: B&W 500 watt swinging link & coils assy.
L-7, L-8, L-9, L-10, L-11, L-12: see text
R-1, R2: 33 ohms, 2 watts carbon.
R-3: 10 megohm, 1 watt.
T1: 10 volts, 10 amp. filament transformer.
Chassis 13"x17"x4" aluminum.
Tm-1, Tm-2, Tm-3, Tm-4, Tm-5, Tm-7: Jones terminal strip.
Cn: see text
Not diagrammed: 3 coaxial junction connectors.
Tm6 — High voltage feed through & Terminal.
1 — 90 angle drive assembly.
1 — Shaft coupler, 1/4".





long side of the chassis. Horizontal strips measuring ½"x½"x13 and ½"x½"x17 are mounted along the top and bottom of the sides and front and back of the assembly to complete the box structure. These are secured with self-tapping metal screws to the chassis and other angle members.

The bronze screening is stretched over the top and sides. It is "tacked" with solder to 1/8" rod supports which are run diagonally between the top corners. The screening is terminated just below the top of the chassis, at each side. A strip of aluminum is placed over the end of the screening for the entire width of the chassis to maintain good bonding to the chassis.

The front subpanel and rear-door aluminum sections were scavenged from BC-375 tuning units. A length of piano hinge allows the rear door to open from the top where it is secured by a captive thumb screw. The door hinge should be mounted in such a manner as to allow the door to lap the top enclosure angle sufficiently for good electrical contact along the top surface.

The main front panel is a standard 10½x19" door type with two ventilating grills which were removed and glass installed in their place. Bronze screening is placed over the inner surface of the glass and bonded to the steel panel to complete the continuity of the cabinet shielding. It will be noted that the 10½" front panel does not entirely allow for the overall height of the amplifier. An additional 1¾"x19" filler strip completes the front paneling and facilitates easier installation or removal of the amplifier from its cabinet.

All parts except the right-angle drive for the swinging link are mounted on the chassis. Its 4" depth allows adequate clearance for the *MB-40L* grid tank assembly and the filament transformer. To better utilize the available depth of a standard cabinet rack and to obtain the use of the entire chassis width the front panel and chassis are spaced apart by four 1¼" standoffs sawed from ½" tubing. Four 10/32 bolts hold the front panel to the chassis and screening enclosure. If the structure angles are fabricated to the same size as described here it is not necessary to use panel brackets.

The *CX-45-B* plate tank condenser is mounted at the front center of the chassis. Its back end plate is modified slightly to permit the coil jack bar and swinging link assembly to be attached so that the link swings up and coil changing can be accomplished by opening the rear enclosure door. The plate tank output link is adjustable from the front subpanel through a right-angle drive gear mounted on the upper right screening enclosure angle strip. To prevent a possible unbalance of the plate tank symmetry a non-metallic shaft material is used. A standard panel bearing admits the shaft through the right-hand side of the front subpanel.

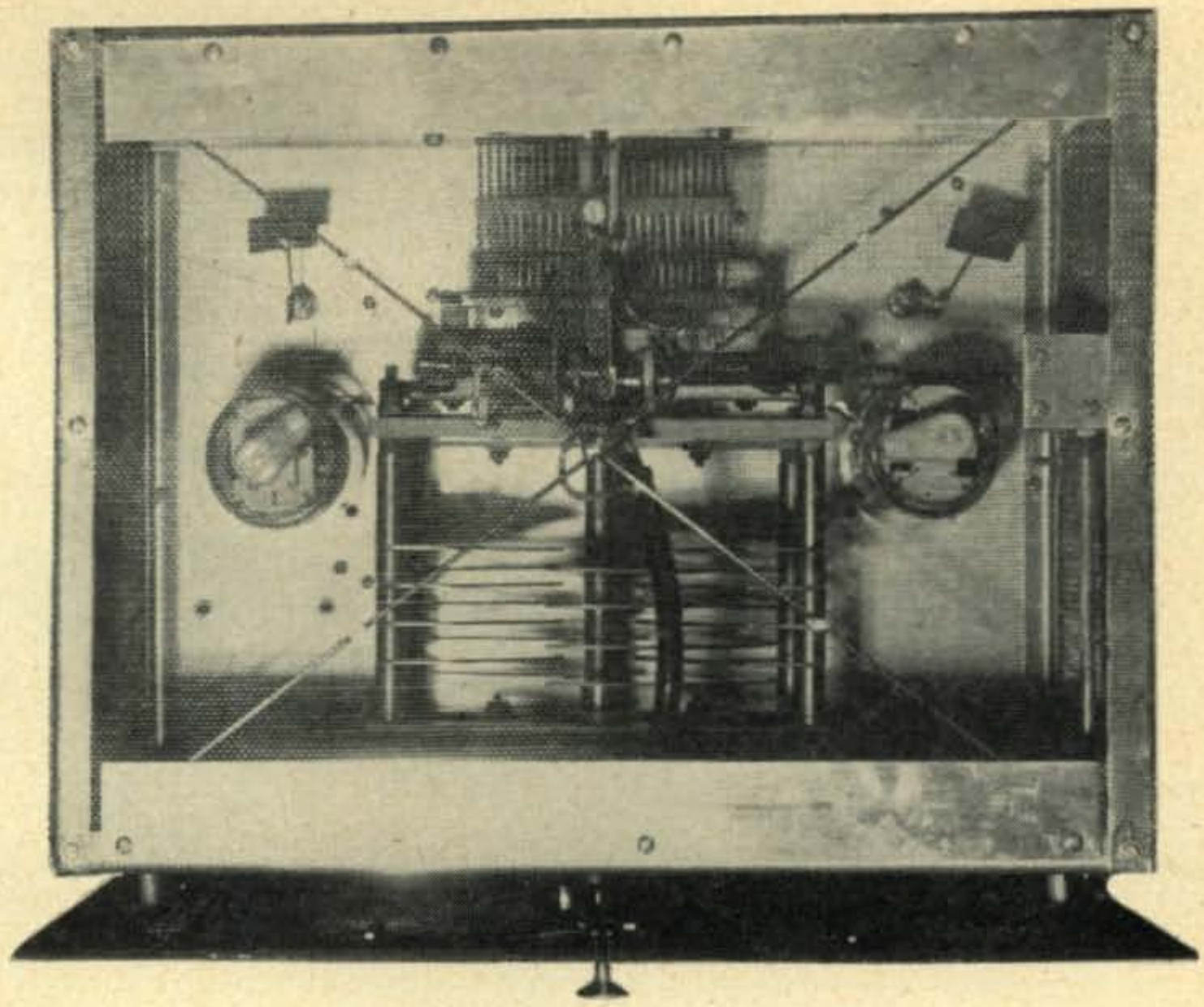
A 3"x1" phenolic strip is attached to the inner side of the rear bracket of the plate tank condenser and allowed to project upward. This provides a terminal for the output coaxial cable and the pigtails to the swinging link. The link output series condenser *C-21* is also mounted on this strip. *C-21* does not require frequent adjustment, so the shaft may be shortened and slotted for screw driver tuning.

The 813 sockets are located to either side of the back end of the tank condenser such that the plate leads are just long enough (¾") to facilitate removal of the plate connector. Care should be exercised not to locate the tubes so far to the rear as to place them in the strong r-f field of the tank coil.

Neutralization is accomplished by small capacitors consisting of short lengths of buss wire. These are attached to feed-through insulators which are located two inches to the rear of the tube sockets.

Coaxial cable junction connectors are used as feed-throughs for passing the RG8-U through the front of the chassis. The cable is routed from the link terminal strip, under the top center of the screened enclosure and down the inner side of the front subpanel to the coaxial feed through. Coaxial feed throughs are also used to route the cable in and out of the low-pass filter box which is located in the forward left corner, below the chassis. Inside the filter shield small banana plugs with soldering lugs attached are fitted snugly into the coaxial feed throughs. The filter network coils are soldered directly to these with no other support except for the network filter capacitors.

All capacitors used in the low-pass filter are of the *TV Centralab* series, having a 6/32 stud on one end and tapped for 6/32 machine screw on the other. If substitutions are used care should be exercised to select capacitors having a low inductance. *C-19*, *20* and *22* are rated at 50 $\mu\mu$fd. *C-18* is 150 $\mu\mu$fd and consists of three 50 $\mu\mu$fd capacitors in parallel. *L2*, *L3* and *L5* are wound from a continuous length of #12 wire. *L1* and *L6* should be mounted as closely as possible to the input and output connectors of the filter. All coils should be wound on forms of the diameter indicated. The turns should then be spread to conform to the correct coil



length. It is recommended that the coils not be placed closer than one diameter to the shield wall or chassis.

Coil Data

L-10,L-12-4 turns #12 on ½" dia. form,½" long.
L-7 ,L-9 -6 " #12 " 5/8" " " ,¾" " .
L-8 - - -7 " #12 " 5/8" " " ,1" " .
L-11 - - -4 " #12 " 5/16" " " ,½" " .

All leads entering or leaving the chassis are filtered. The a-c line chokes consist of 45 turns of #14 enamel insulated wire wound on a length of 3/8" wooden dowel. The dowels are attached to the chassis with 6/32 stud screws which are cemented into a hole drilled in the ends of the dowels. Chokes for other lead filtering are *Ohmite Z-50*. Bypass capacitors for all except the plate high voltage line are of the disc ceramic type, rated at 500 μμfd (*Centralab DD 60-501*). The screen bypass capacitors are rated at 500 μμfd with higher voltage to allow for audio peaks. (*Centralab 11L-037*).

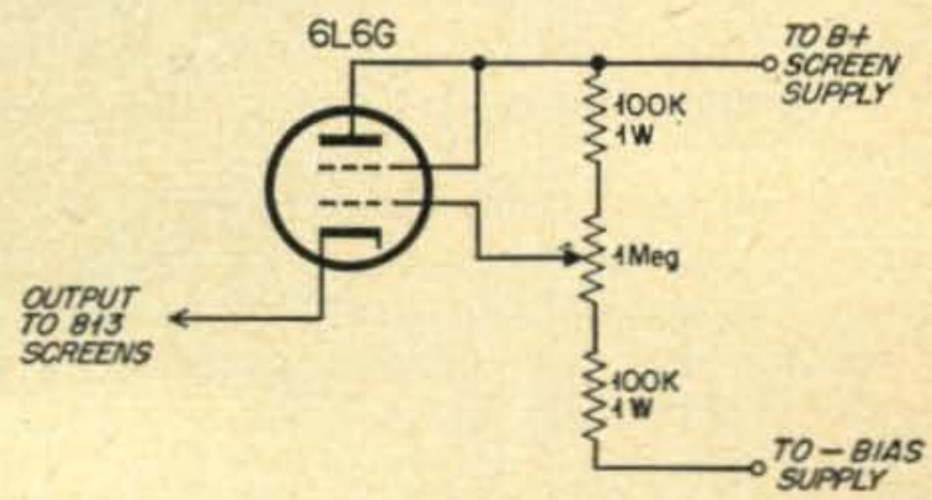
Wiring

After mounting all components it is suggested that the 115-volt line and filament leads be installed first. These are wired with #14 shielded, grounding the braid at frequent intervals. Other wiring, except for r.f. and the high voltage lead, is run with #20 shielded. The r-f leads are tinned buss wire with a protective spaghetti insulation. The plate voltage is wired with a short length of RG-8U. The high voltage is bypassed at its entrance into the chassis and at its feed-through point by 500 μμfd, 10kv., TV capacitors. (*Centralab TV3-501*)

Not shown in any of the figures is a chassis bottom cover. It should be drilled for ventilation of the filament transformer.

Screen Supply Precautions

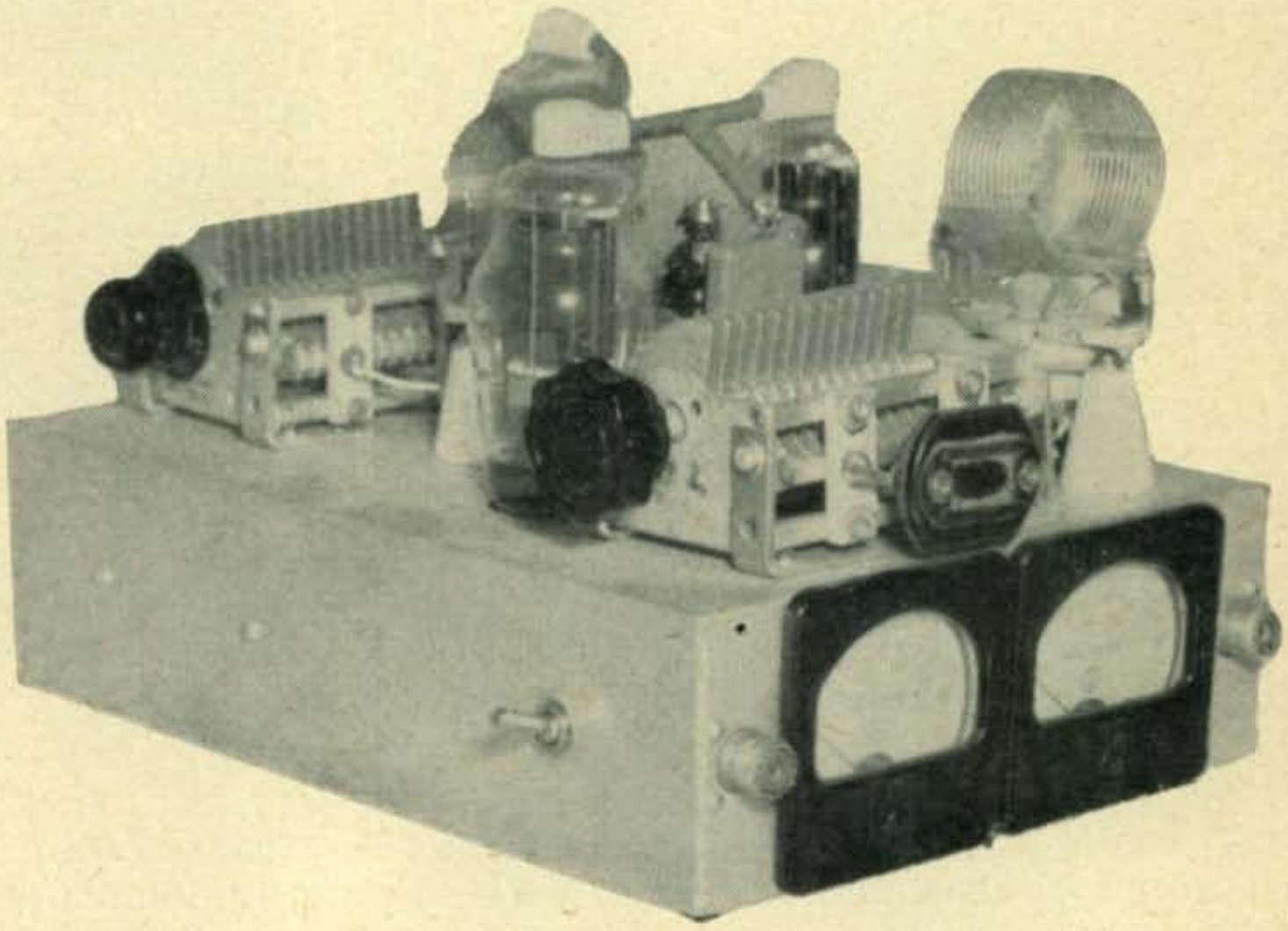
As in all tetrode amplifiers the manipulation of the screen voltage and current is of vital importance. It will be noted that the circuit of the amplifier has provision for metering each screen lead. This is handy for comparing the two tubes. During tuning operations it is recommended that the screen voltage be reduced to prevent possible tube damage. Above all, *never* leave the amplifier running with screen voltage applied and plate voltage removed. Although not actually part of the amplifier the following arrangement is used for screen current adjustment during tuning.



The 6L6G connected as a triode acts as a manually-controlled series regulator. During tuning operations the amplifier may be completely or partially cut off as desired by adjustment of the potentiometer. One 6L6G tube connected as above will handle the screen current for two 813 tubes without overloading. A drop of about 80 volts can be expected across the tube and should be considered when designing the screen supply.

[*Continued on page* 100]

Norman R. Mc Laughlin, W6GEG
4143 Muirfield Road
Los Angeles, 8, California



Driver stages at W6FIS, an 837 driving a pair of 837's. Condenser to left tunes tank circuit of single 837, cap of which may be seen peering over tank coil. Forward condenser tunes parallel 837's. Meters read plate currents of each stage. Input to drivers is through coax connector at right. Output is from connector at left.

QRO[10]

or Something for Almost Nothing

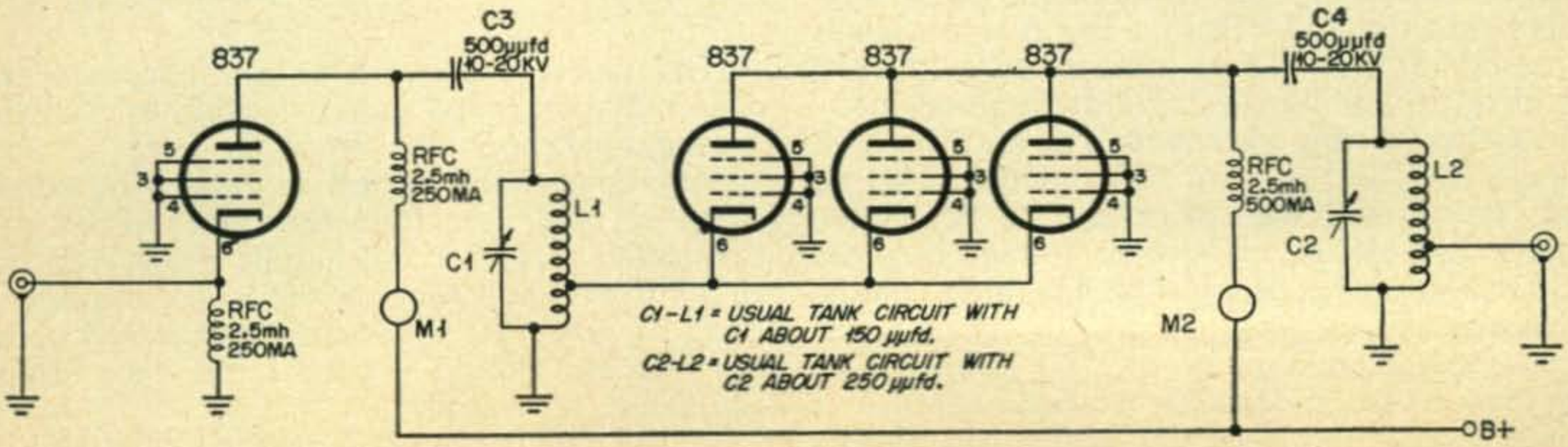
In the usual transition from flea power to higher power, the old rig invariably ends up in the junk box . . . . in pieces. Despite an enviable DX record, hours of faithful emergency service, winning the last Sweepstakes and its unflinching assaults upon kilowatt competitors its doom is determined as soon as its master decides to increase power through conventional methods.

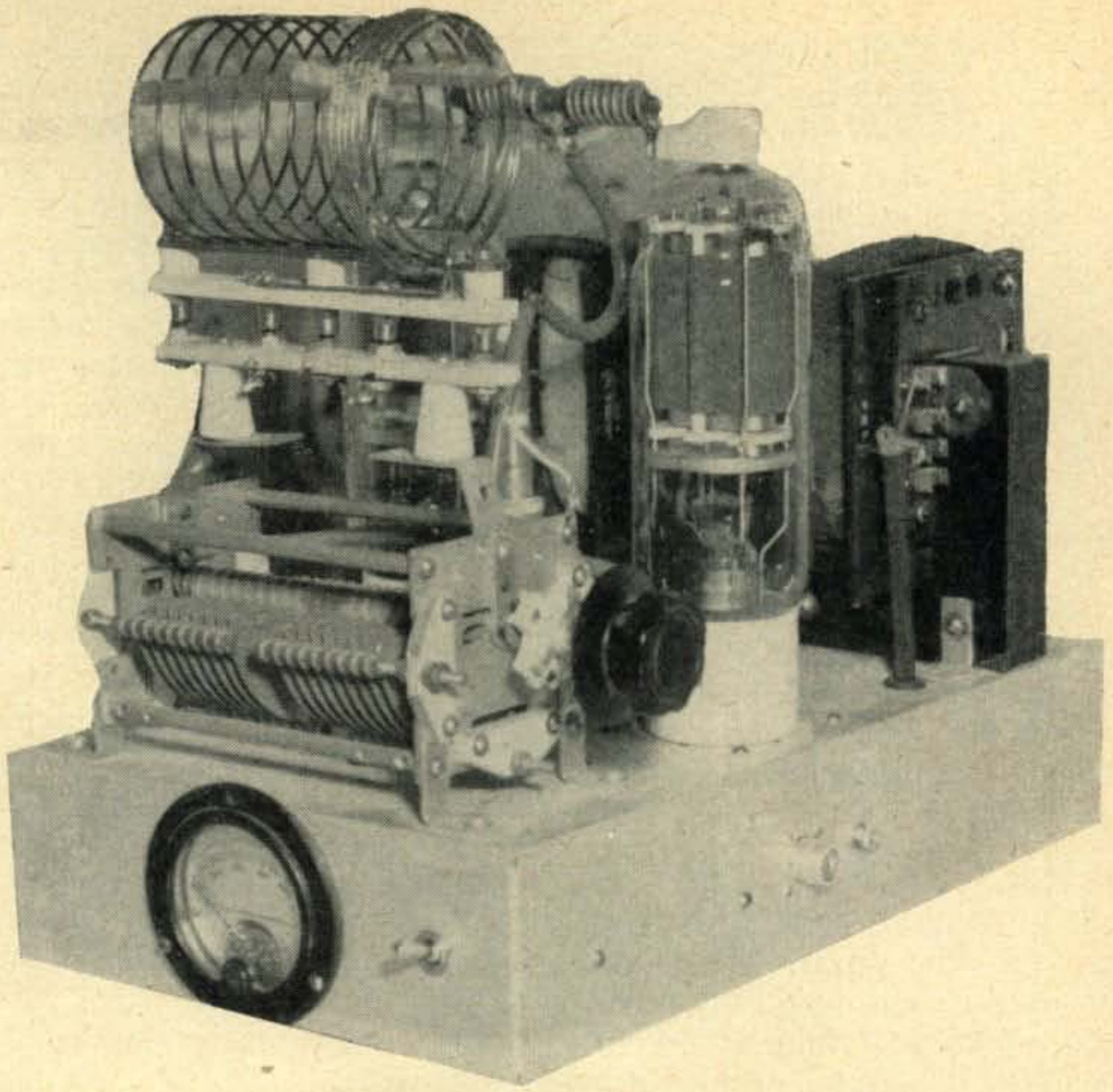
That such brave warriors need never die is shown in what follows. It must be admitted, however, that a power increase of 10 with a minimum of cash outlay and effort, *not* a transmitter's righteous reward fathered the ensuing thoughts.

As may be seen from the schematic, *Figure 1*, four war surplus tubes, three r-f chokes, two blocking condensers and usual plate tank circuits are all that are needed to boost a flea power AM phone up to 100 watts output. In CW service output in excess of a quarter kilowatt is readily possible, yet tubes and parts needed to do the trick cost less than what one would pay for a good 75 watt modulation transformer.

Thus a 10 watt phone transmitter aided by a pair of grounded-grid Class B Linear Amplifiers becomes a medium powered transmitter that will hold its own among the best of them. The flea power transmitter drives a grounded grid 837 which in turn drives three 837's in parallel. Power output will be in excess of 100 watts or a power gain of 10, which is a sizable increase in any league.

Certainly no simpler arrangement could be devised, to get this increase, than is shown in *Figure 1*. Note that (a) no neutralization is required (b) no grid bias is necessary and (c) there are no tuned input circuits. Both driver





This 10x17x3" chassis houses W6FIS's KW final. Parallel 803's do the job. Low-capacity surplus filament transformers are mounted to rear. Since Irv couldn't find one transformer to do the job he put a separate transformer on each 803. As a precautionary measure he added parasitic chokes in the plate circuit. Input is through the coaxial connector on the side.

and final amplifier operate from the same power supply and one filament transformer can supply current for both stages.

Since the available plate dissipation limits final amplifier input there is little point in using more than 1,000 volts on the plates. At 12 watts rated plate dissipation the 837 is probably radio's most underrated tube. Its actual dissipation is much closer to 75 watts. Regardless of actual rating, the three tubes in the final handle 300 watts input low level modulated without a trace of color.

For the flea power phone man, this is a bonanza. If he were to obtain a hundred watts output by the usual means he would need at least the following:

1—75 watt modulation transformer
2—Pair of modulator tubes that will handle 75 watts
3—Driver transformer for modulator tubes
4—New speech amplifier to drive modulators
5—Power supply for 75 watt modulator
6—Final amplifier capable of 150 watts input
7—Power supply for new final
8—Tube or tubes for 150 watt final

If any doubt exists as to the economy and simplicity of the Class B Linear method of getting that 100 watts output a comparison of the above requirements with paragraph two should settle it. From either the standpoint of cost or convenience in building, the 837's win by several wavelengths!

The amateur radio fraternity has frowned upon Class B R-F Linears and not entirely without cause. Compared to Class C amplifiers, they're inefficient. They have been tricky to adjust, what with bias, drive and load to properly balance. Then, too, they are seemingly hard to understand.

Interest was revived when single sideband suppressed carrier swept the country. These linears, or their AB_1 and AB_2 kinfolk, provided the best means of amplifying the low output of single sidebands exciters. Sidebanders soon found that Class B efficiencies comparable to those of Class C amplifiers were possible. Elimination of the power wasting carrier made this possible.

By using tetrodes and pentodes in grounded grid linears they found much of the Class B trickiness of adjustment was eliminated. These tubes, so connected, take on characteristics of high-μ triodes. At voltages reasonably near maximum they operate as zero bias tubes. This eliminates bias problems.

Drive problems are likewise minimized due to the low input impedance of grounded grid circuits. Swamping resistors are unnecessary

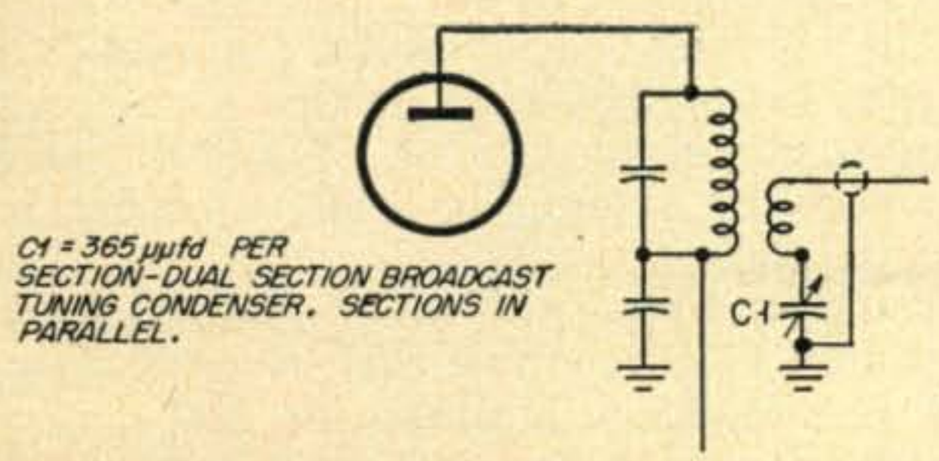
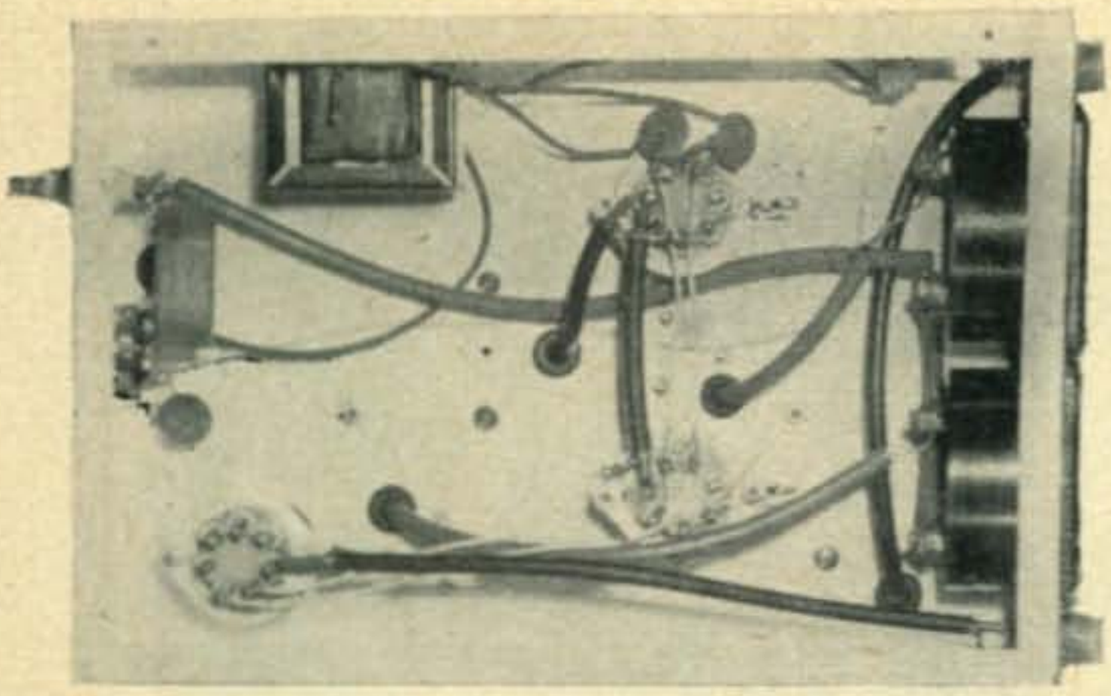


Figure 2. Output tank circuit of fleapower AM transmitter that has now become a driver. C1=365 $\mu\mu$fd. broadcast tuning condenser with both sections in parallel.



Beneath chassis measuring 10x14x3" are, left to right, plate blocking condenser, single 837 socket, filament transformer for the three 837's, bypass condensers from filaments to ground, and plate meters. Except for the cathode and filament terminals, all socket connectors are grounded to chassis at socket mounting bolts.

and matching driver output to Class B stage input is comparatively simple.

Because the circuit is degenerative, no neutralization is required. In fact, stability is greater in grounded grid than in conventional circuits. This same degeneration also prevents distortion from being generated in the stage itself. As a result the only distortion that might appear in the output signal is generated ahead of the 837's, in this instance. Since this is at comparatively low level, correcting the cause of distortion is not difficult.

Boosting that flea power to a more respectable 100 watts takes no more doing than the following. This step by step procedure assumes that no wiring errors have been made in *Figure 1*. Because of the simple circuitry this is not a bold assumption.

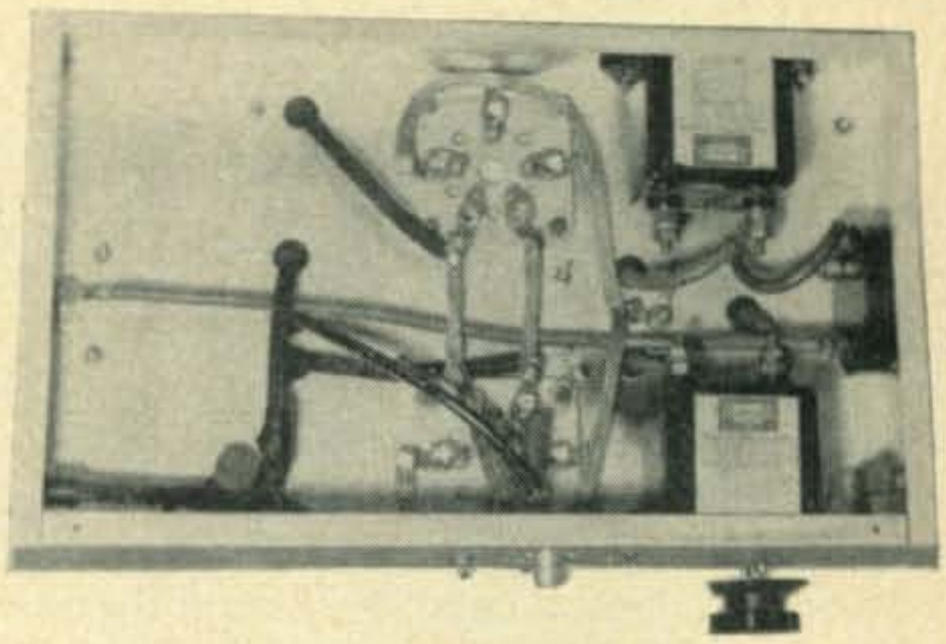
The flea power AM transmitter which we shall now call the driver is disconnected from the antenna and its output connected into the cathode of the first 837 stage. While the addition of the condenser *C1* shown in *Figure 2* is not absolutely essential, it is worth while. This is particularly true if the coax, which can be either 50 or 70 ohms, is going to be ten feet or so in length.

What the driver "looks into" is shown schematically in *Figure 3a*, so far as the first 837 stage is concerned. Here the cathode impedance is in series with the plate resistance, both of which are shunted by the output impedance. Actually, the driver looks into both stages and impedance-wise its load appears as *Figure 3b*.

From *Figure 3* it can be seen why the output circuits of grounded-grid amplifiers must be kept in resonance when preceeding stages are being tuned. From this it should be obvious that unless this is done the output impedance Z_o is not at its true value. Since it is shunted across the plate resistances in series with the cathode impedances their values are altered by variations in Z_o.

So, with the plate voltage on the first 837 stage *only*, *C1* and *C2*, as well as the antenna coupler, if any, are rocked until the plate current as indicated on *M1* approximates 50 milliamperes. The driver output should be touched up also to be sure optimum coupling has been obtained.

Should the plate current be less than required, the tap on *L1* should be moved. Start at about four turns. Then move up or down as determined by *M1* readings. Each time, *C1*, *C2* and and the antenna tuner should be retuned. The tap position might be critical and as little as a quarter of a turn might make a decided difference. It should go without saying that tap adjustments are best made with the high voltage OFF!



Sheer simplicity of grounded-grid circuitry is depicted here. Under the 10x17x3" chassis on which the 803's sit are just two plate bypass condensers, sockets and the aft end of the plate meter. Wire braid is used to ground all except the filament terminals of the sockets.

Now apply plate voltage, without excitation, to the final amplifier. The static plate current of the three 837's probably will be very low, which is normal. With excitation applied the plate current should rise to 100 ma. or so. Jockeying *C2*, the antenna coupler and *C1* should bring it up to the wanted 300 ma. If this is not possible readjustment of the tap on *L1* and closer coupling with the antenna coupler will bring input up to normal.

Should you have too much plate current on the three 837's, decouple the driver slightly. At least, reduce drive to where the 300 ma. point is reached.

With the carrier on set the speech amplifier gain control to about its normal position when the driver used to be just a flea power transmitter. A whistle or loud count into the micro-

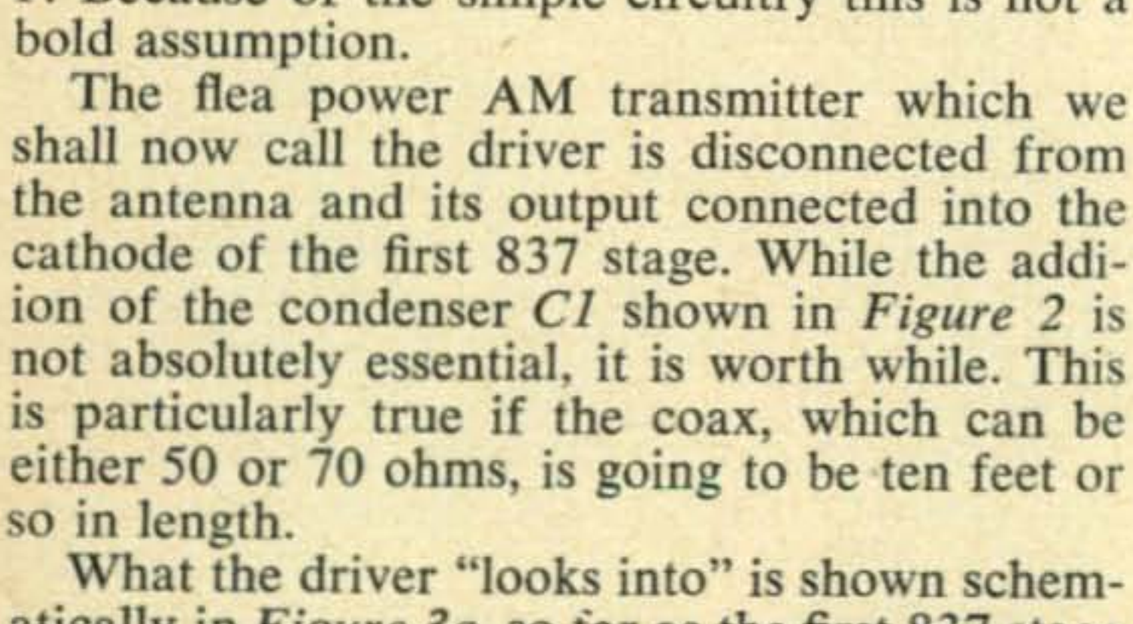


Figure 3. Equivalent circuit.

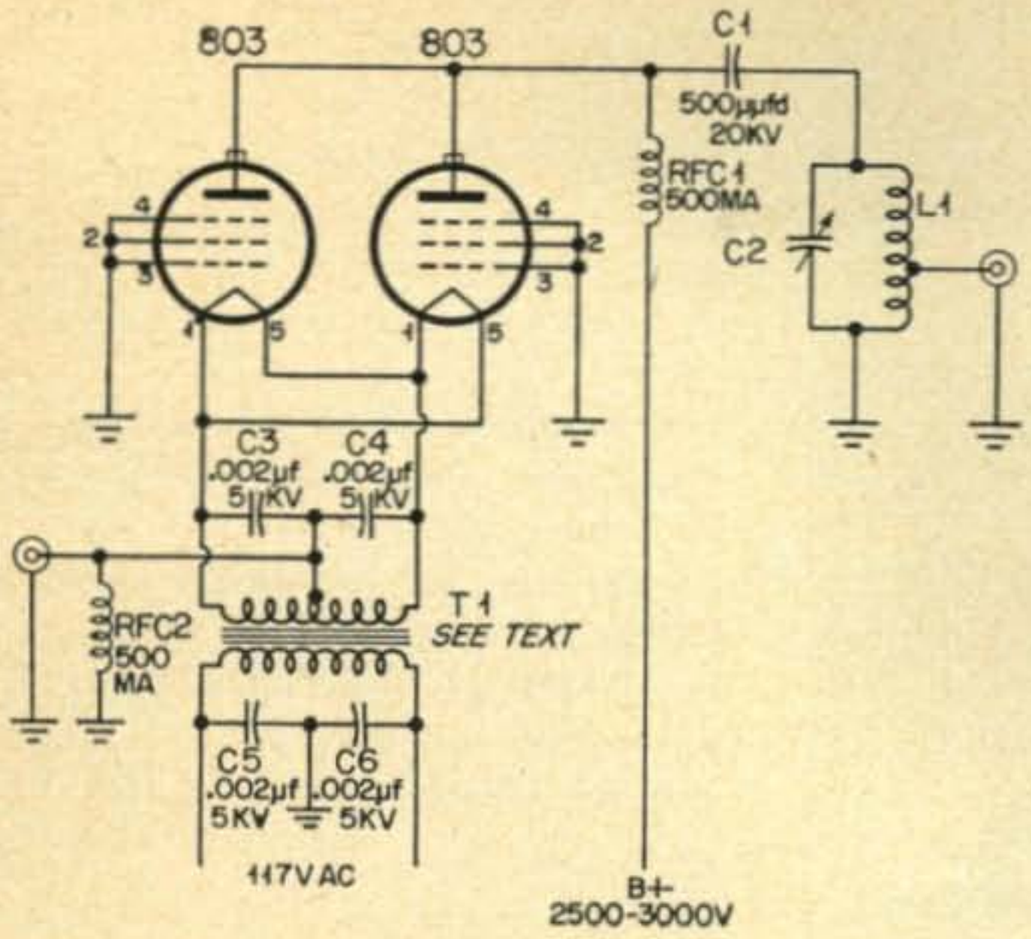


Figure 4. Grounded-grid 803's.

phone should cause quite a swing in *M1* and *M2*. Should this occur, reduce the speech level until needles just barely fiicker on modulation peaks.

If you have an oscilloscope the usual carrier should be evident. Speech level should be adjusted to the point where 100% modulation patterns are seen on modulation peaks.

That's all there is to it. You're on the air with 100 watts of power. You'll be pleasantly surprised by the signal reports.

For the strictly CW man the procedure is about the same. However, he can run a little higher input with safety due to the shorter duty cycle of the 837's on CW. He can get this additional input by increasing plate voltage on both stages to 1500 volts or so. The 837's will handle 1500 volts readily.

The limiting factor on CW is plate dissipation. Input should be kept below the point where tubes show color. Even though the tubes sell for only a dollar or so apiece it's still poor economy to run them red.

If additional power is wanted a much better approach is to build a final such as is shown in *Figure 4*. Here two 803's replace the three 837's. With plate voltages between 2,500 and 3,000 volts the 803's will handle a kilowatt input while loafing.

It is a common misconception that such parallel tube finals will not work properly on the higher frequencies. Actually that is one of the principal reasons for grounded-grid amplifiers in commercial service. Grounded-grid circuitry serieses rather than parallels interelectrode capacities. As a result jugs that won't perform well at even 2 megacycles in conventional circuits perform like demons on 20 Mc. in grounded-grid.

Likewise, interelectrode capacities given by manufacturers on tube data sheets are incorrect for grounded-grid circuitry. They were determined in conventional circuits.

Some misunderstanding also exists regarding the filament transformers required. So far as the 837's are concerned, any transformer that will supply sufficient current and has adequate insulation will suffice. Since the cathodes are driven, the filament transformer functions solely to provide heater current.

Such is not the case where 803's are used, as per *Figure 4*. Since 803's have no cathode, the filaments themselves are driven. This can be accomplished in a number of ways, including use of bi-filar coils. However, the most effective inexpensive means is to drive the center tap itself.

Ordinary open frame filament transformers will perform well on 3.5 and 7.0 megacycles. In some cases filament transformers that were cased and potted have worked satisfactorily on 3.5. The open frame type is to be preferred, nonetheless.

On higher than 7.0 megacycle frequencies

Operating position of W6FIS, Bakersfield, Calif. A 10A SSB exciter, a BC-458 VFO, 75A3 receiver and LM frequency meter are neatly assembled from left to right. The loudspeaker is on the floor, under the desk. Watch that upper-left-hand door as you turn to the next picture. That former linen closet houses the transmitter!

On the air, W6FIS looks like this. This former linen closet, from top to bottom, now houses on the top shelf a 1200-volt power supply for the 837's. A 2,500-volt supply for the 803's is next, while the lower shelf contains the 803 final and the 837 drivers.

low capacity transformers are essential. These may be obtained at most surplus stores. They were originally used in radar installations. Secondaries will have to be rewound to ten volts, since most of such transformers put out either 5 or 7.5 volts.

These transformers need not be insulated from the chassis. Nor has any necessity for r-f chokes in the primary leads been found. The usual bypass condensers from each side of the line to ground seem to suffice.

It goes without saying that the *Figure 1* arrangement is ideal for SSB. In fact it is probably the most popular tube circuitry among W6 sidebanders. Linearity of the two grounded grid stages is excellent.

Irv Wehe, W6FIS, has combined the layout of *Figure 1* with that of *Figure 4*. The net result is as sweet sounding SSB signal as will be found on 75 meters. His 10A exciter operates with the speech level set at about eight o'clock. Even at this low level, a cough or a sneeze pins the 500 mil meter in Irv's final. (That's why he always has cough drops and Kleenex handy!)

He puts 2,500 volts on the plates of the 803's. The 837's are fed with 1,250 volts. As may be imagined, everything loafs at a kilowatt input. This is probably another reason why W6FIS has such outstanding signals.

But, the virtues of grounded-grid are not exclusive with sidebanders. The low power AM phone man has as much to gain. At least until a simpler method comes along, the 837 lashup described herein provides him with the easiest and least expensive means of getting a husky power increase.

A beautiful usable adornment for the hamshack, living room, game room or library—the CQ World Globe. See page 97.

New Book

"Experimental Electronics for the Beginner" by Crow and Blevins, published by the Universal Scientific Company, Inc., 1102 Shelby Street, Vincennes, Indiana at $3.50 per copy is a combination text book and lab manual for starting at the bottom in electronics. The 360 page book is profusely illustrated with large photographs and diagrams of experiments that can be made to help understand the workings of electricity and various electronic components. The book sticks to electricity and does not go into amateur radio, however it should be perhaps pointed out that a knowledge of electricity has always proven useful to those amateurs who have it.

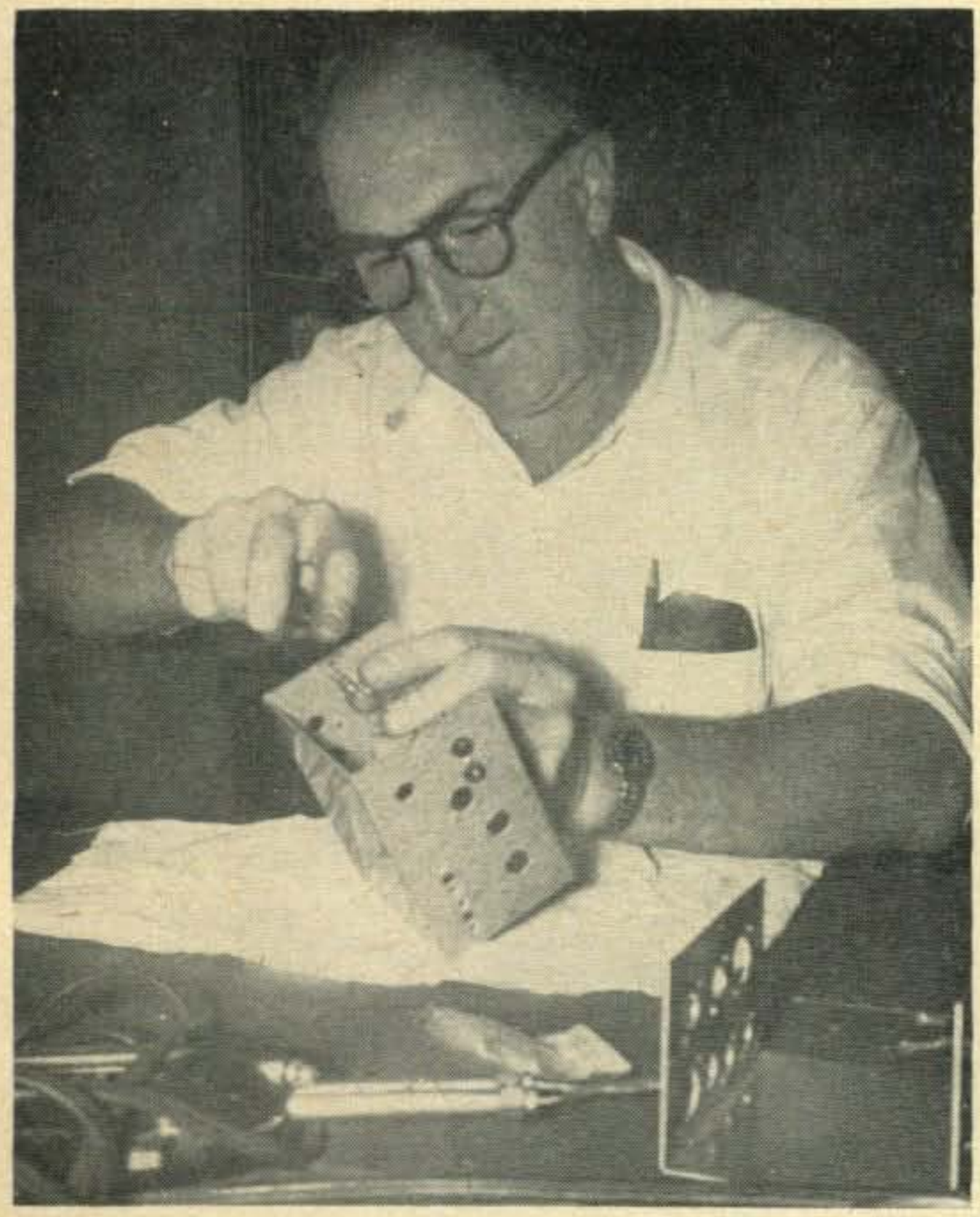
How to build up interest in your ham club

Photos by W2JUN

"The Levittown Solution"

Byron G. Wels, K2AVB
6 Timber Lane, Levittown, L.I., N.Y.

The Civil Defense organization in Levittown was unhappy. They had to rely on the local fuel oil company service cars for mobile communications. These cars, equipped with two-way radio on 465 Mc., were the only local two-way mobiles on the same frequency. We at the Levittown Amateur radio Club realized that comunications for C.D., mobile OR fixed, were our job, and that we weren't doing it.

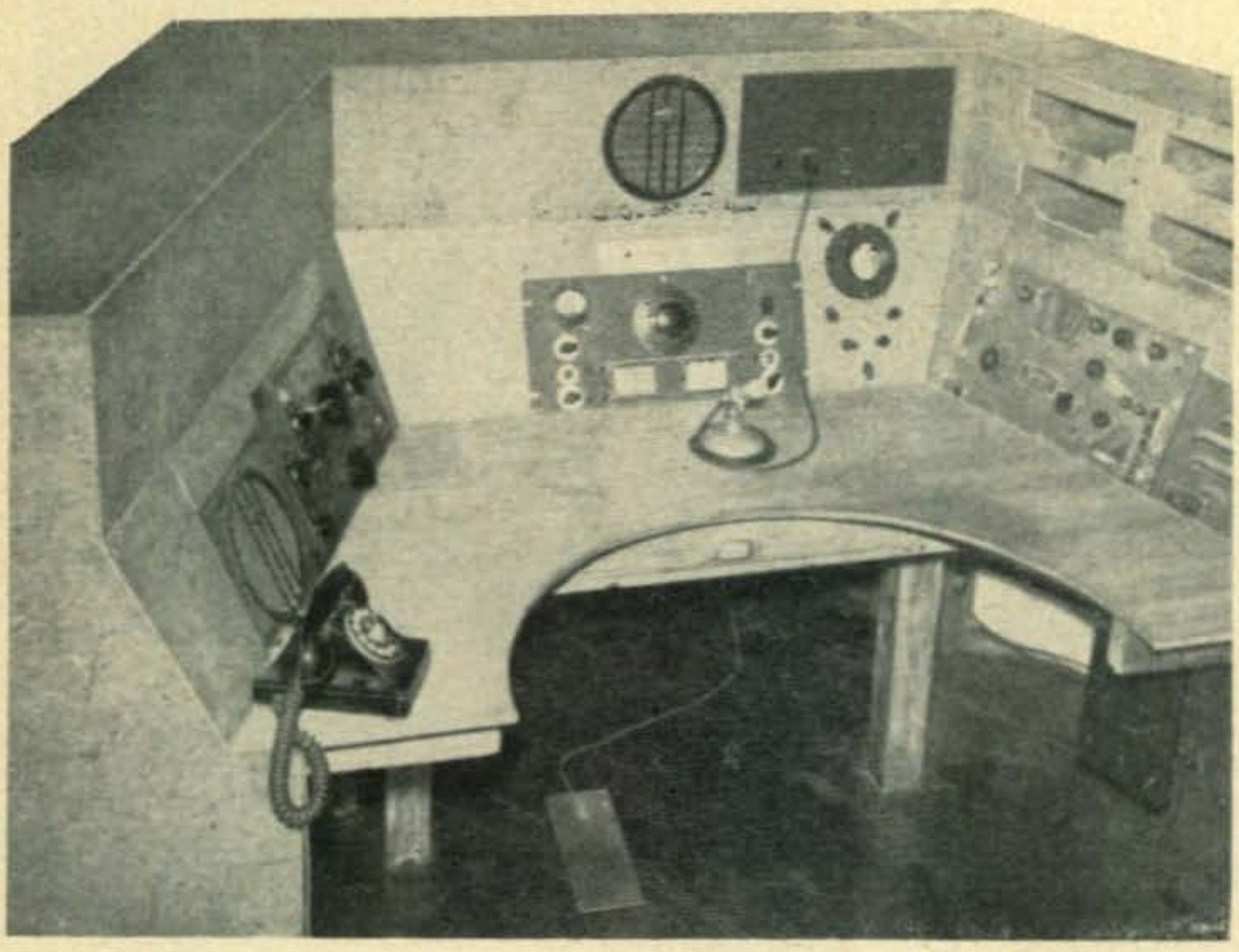


Now you can't order a ham to buy or build mobile equipment and install it in his car. If you recommend that certain equipment be installed, those who are equipped with ten meter gear want to operate mobile on ten. Those with twenty meter gear want to operate twenty. It seemed that nobody wanted to undertake the job, and we had reached a stalemate.

One club member, a technician, solved the problem. Undertake, as a club project, the construction of six and ten meter transmitter-receivers. He was appointed as a committee of one to investigate the subject and come back with dollars and cents figures. Here was an opportunity to get the club interested in a new group activity, *and* get the individual members on a new frequency. (The technician obviously had ulterior motives. . . . He wanted to populate six meters.) The schematic diagram was taken entirely from CQ magazine, using the transmitter portion of the "Ten/Six Packset". The only required changes were the substitution of a 1.2K resistor in the first speech amplifier stage of the modulator circuit, as the microphones didn't supply sufficient bias.

The big item in convincing the membership that this project was worthwhile was the total cost. An estimated five dollars was to cover the cost of the transmitter. This low figure could be achieved only by careful purchasing. As only twenty-five members expressed an immediate interest, the number of sets to be built in the first batch was limited to twenty-five. An additional twenty-five have since asked to form a

[*Continued on page 122*]



a Deluxe Console

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Upon moving K3WAG[1] to a new location we found ourselves presented with the situation of setting up in the old haphazard way on tables. Operation during emergency periods had already convinced us that we could well spend a few of our off-duty hours constructing a console to make operating a real pleasure.

In thinking over the problem we came up with five "musts":

1. Safe operating conditions—no danger of shock.
2. Operating convenience—including
   (a) Slanting lower section for ease of reading dials and manipulating controls, and
   (b) Semi-circular operating front giving plenty of room for mike, key, and writing space.
3. Easy access to equipment for repair. Removal just a matter of lifting out.
4. Room for new equipment.
5. Neat appearance with wires concealed.

After taking an inventory of present equipment and listing the other equipment we wanted (within reason), we roughly located equipment using pencil and paper. Since our largest piece of equipment was only 10½" high, the lower section was given a slant height of 12". This required 11" of vertical height. The upper section adds another 10¼" in height.

The lower center section contains a National HRO receiver placed in the center. To the right of the receiver is a Moniscope for monitoring modulation of transmitted and received signals.[2] A panoramic adaptor (oscilloscope with auxiliary unit for panoramic reception) is planned for the space to the left of the receiver. In the upper center is placed the speaker for the HRO and a home-made speech amplifier for the BC-610 transmitter. The lower left section contains a National 100-ASD receiver with speaker. The lower right contains an Army BC-312 receiver and speaker, beneath which a 1,000-100-kc crystal calibrator is installed. Six "cubby-hole" type boxes take up the entire upper-right section. No equipment has been placed in the upper left, although plans for this space include a phone patch, c-w monitor, and frequency meter.

Our BC-610 transmitter which stands to the right of the console helps explain the three receivers. An additional consideration for the extra receivers is that as a MARS station it is desirable to be able to monitor two frequencies while operating on a third. Plans include TNS[3] to be installed on at least two receivers. In an emergency a second transmitter could be set up to the left of the console for quick change of frequency or simultaneous use of amateur and MARS, or two MARS frequencies.

An ideal place for a small transmitter would be in the lower left section. In this case the speech amplifier and modulator, if external,

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[1]K3WAG. MARS radio station. Bldg 1406, Army Chemical Center, Maryland.
[2]C. O. Bishop, "Presenting the Moniscope," *CQ*, April 1954, Page 15.
[3]Wilfred M. Scherer, "The TNS Twin Noise Squelcher," *CQ*, May 1953, Page 29.

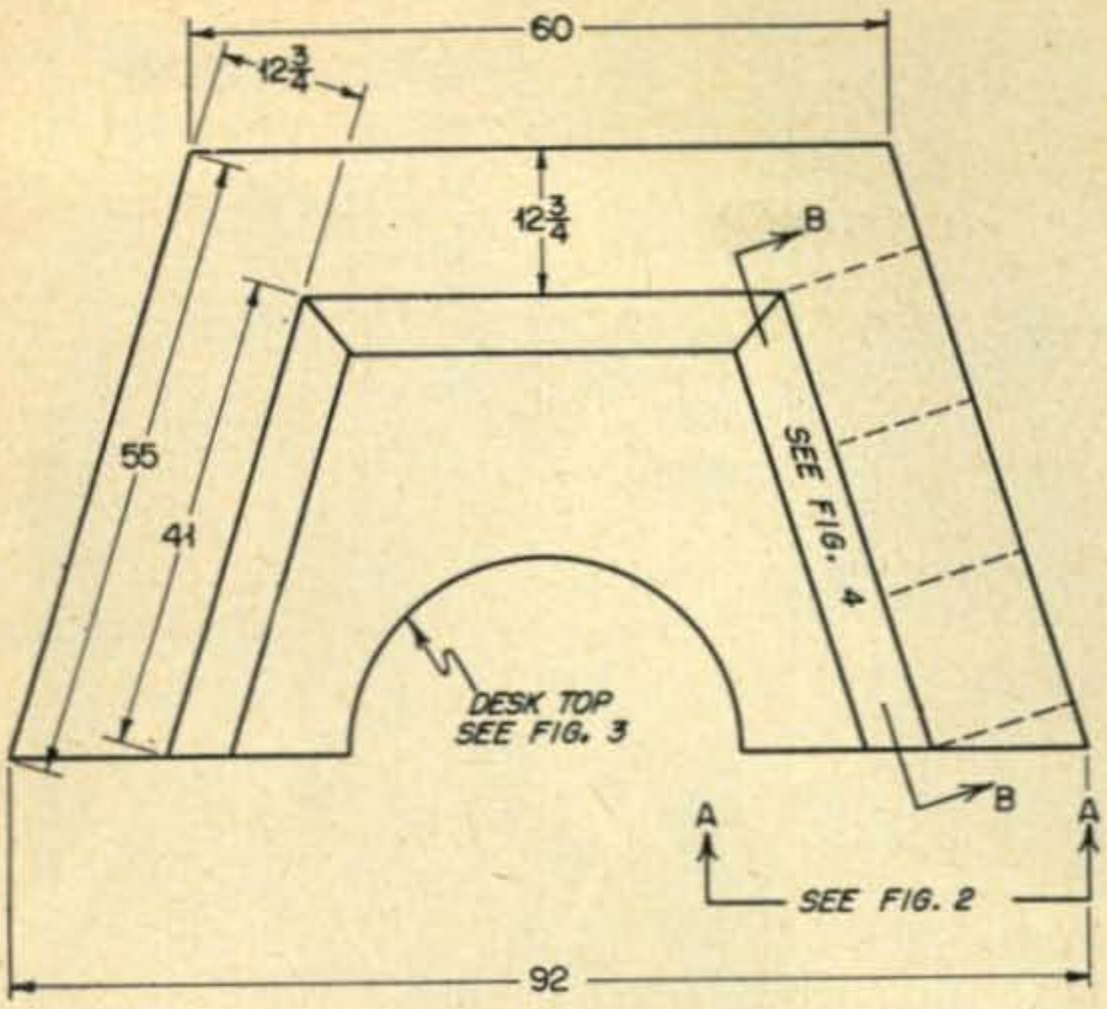


Fig. 1. Console, top view.

could be placed in the upper left section. This would prevent the mike cord from passing in front of the receiver—one of those little things you fail to consider until afterwards. There is plenty of room for power supplies, etc., to be placed underneath and back of the other equipment.

Construction

It is beyond the scope of this article to give a working blueprint of the console. In fact this is probably not desirable as each individual will want to make such modifications as are required for his equipment, space, and needs. However, basic construction is outlined. (See *Fig. 1*)

FRAME: The frame consists of eight 3" x 3" legs, four of which are 29½" long, the other four 51" long. The legs, one side beveled to an angle of 20°, are connected by stringers *A*, *B*, and *C* (*Figure 2*).

Stringers *A* and *B* are cut to a 25° bevel permitting piece *D* to be installed so that each end rests on a solid support. Piece *D*, of course, holds the equipment. A 1" x 2" strip nailed to piece *D* firmly holds the equipment in place. We found it advantageous to use large-headed screws under the rear edge of the equipment to make slight adjustments in height. This allows one to bring the equipment in exact alignment with the masonite front.

Piece *E* connects the outer and inner frames and helps support the plywood desk top.

Piece *F* is cut to the shape shown in *Fig. 2*. It makes a very nice support for the masonite panels. Several short supports (not shown) are used to position piece *F*.

DRAWER: A 3" x 14" x 24" drawer was constructed and placed under the desk top. It provides a good place for the station log and operating instructions which must always be kept handy. In addition, it keeps the top from becoming "cluttered."

DESK TOP: The semi-circular desk top was made of ½" plywood. The dimensions, as shown in *Fig. 3*, are self-explanatory. The only tricky part of making the top was cutting the "V" shape notch in the edge. This was done on a table saw without particular difficulty but required careful holding to make a uniform cut. A simpler method would be as illustrated in *Fig. 3* (cut the plywood to the proper bevel—much easier and just as good).

CONSTRUCTION OF "CUBBY-HOLES": Several patterns were drawn before deciding upon final dimensions. *Figure 4* shows final dimensions and construction details. Removal of the masonite for the hole was fairly easy. First six quarter-inch holes were drilled as shown. The material was then removed by cutting with a jig-saw. Any irregularities were smoothed out with a file.

Dividers were made by sawing blocks of wood to such size that when masonite was nailed on both sides they exactly filled the space between shelves. The masonite on the sides adds greatly to the appearance.

COVERING: Enclosing the frame with masonite was much easier than first expected. Each piece should be "cut-to-fit" as it is almost impossible to make all dimensions exact. The

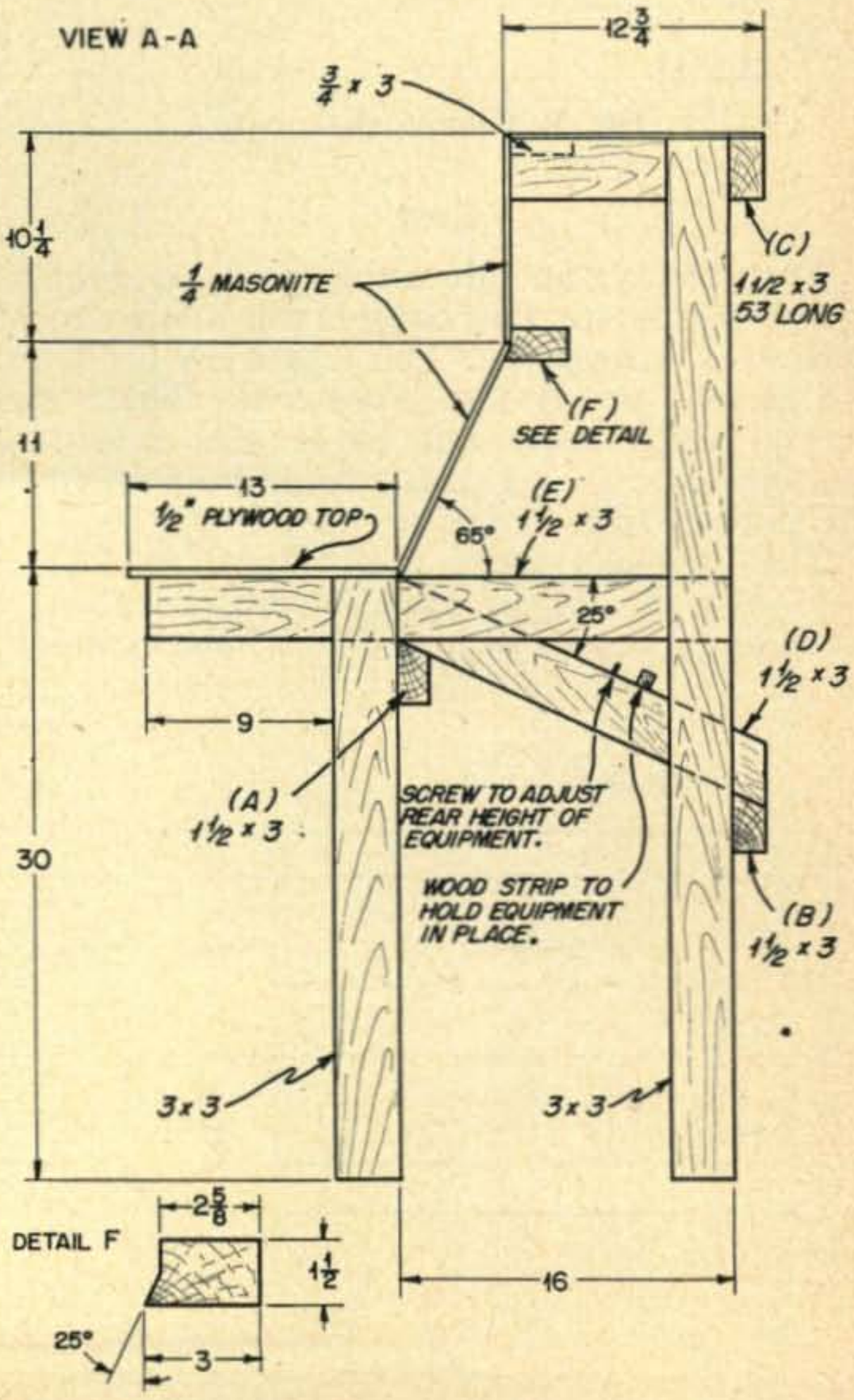


Fig. 2. Console details.

only suggestion along this line is to fit each panel with several small sections rather than one large one. The small cracks which result are hardly noticeable. Should light shine through from behind, they may be covered with black tape on the back side.

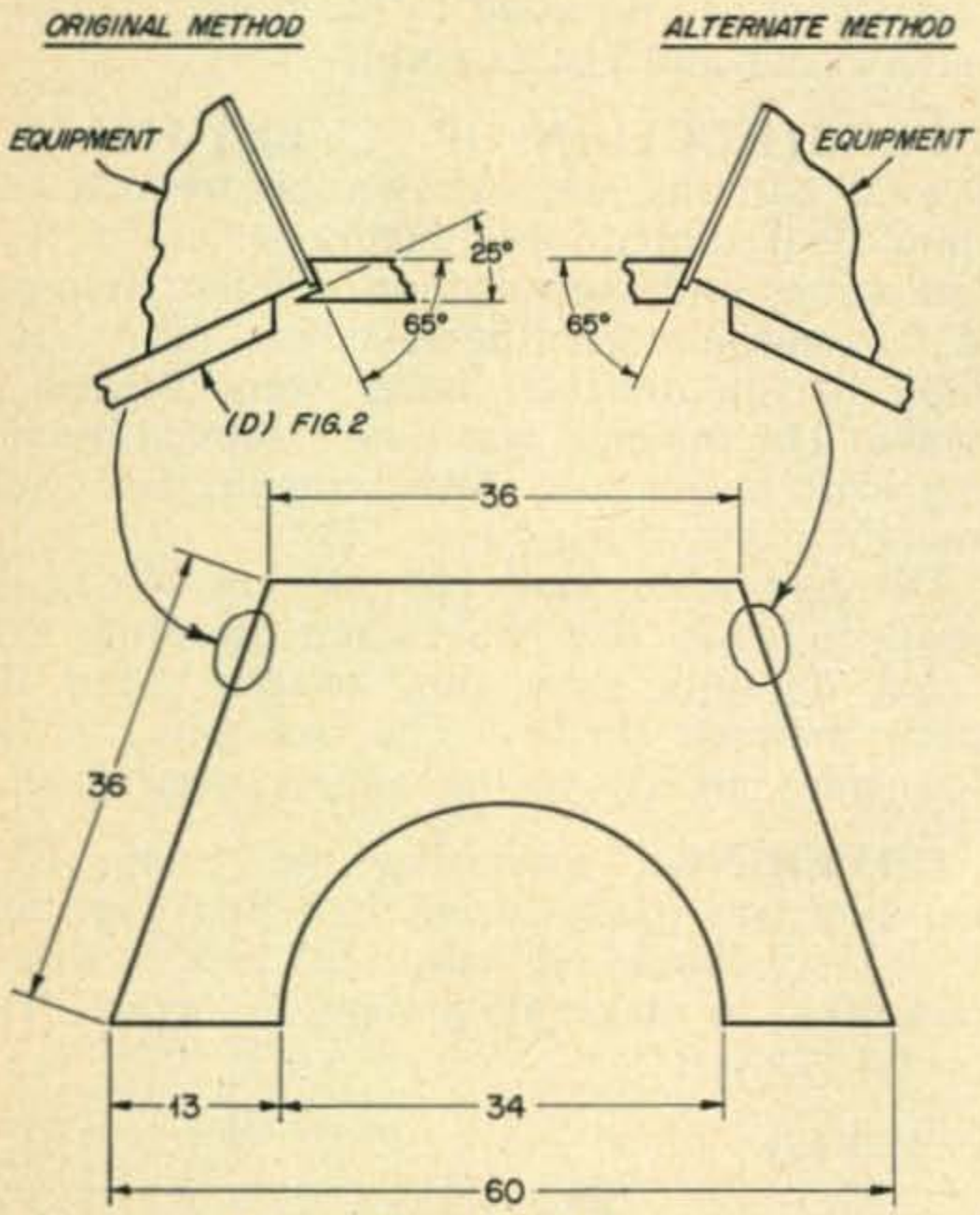
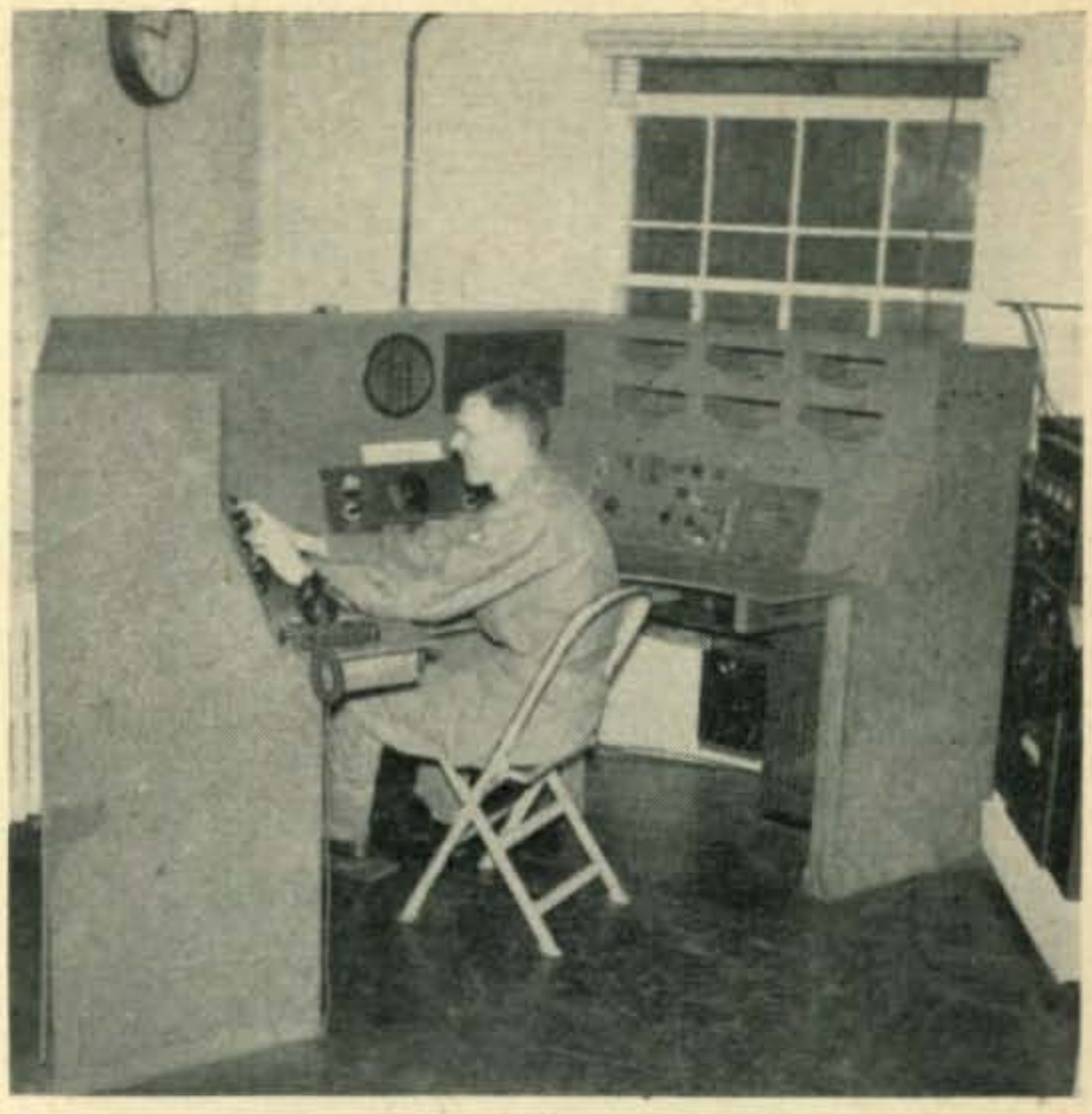


Fig. 3. Console desk top.

Cost

Cost, always an interesting point, is difficult for us to estimate. Our console was made almost entirely from salvage. The legs were cut from old electric power line cross arms. These had several large holes but by careful selection, sections were found which could be worked to the desired size.

The stringers were pretty hard to locate, especially the longer ones. We were fortunate in finding a couple of long 2" x 6" pieces which,



What a difference in operating pleasure!—way out of proportion to the effort required to build a Console.

although pretty badly beaten up, yielded some nice 1½" x 3" stringer material (incidentally, this accounts for the odd dimensions of our lumber). An old warehouse floor furnished the masonite. Admittedly, the masonite has seen better days, but finding it was like a Uranium strike to us.

The ½" plywood used for the desk top was obtained by shaking the "Piggy bank" a few times, as were the nails and a few bolts.

Labor of course was the really hard part to the whole project. Luckily the station is located near the hobby shop where a table saw (practically the only power tool used) was readily available.

No doubt you will find a great deal of pleasure in showing off *your* completed console. However the real satisfaction comes from the many hours of enjoyable operating which come from having all controls at one's finger tips.

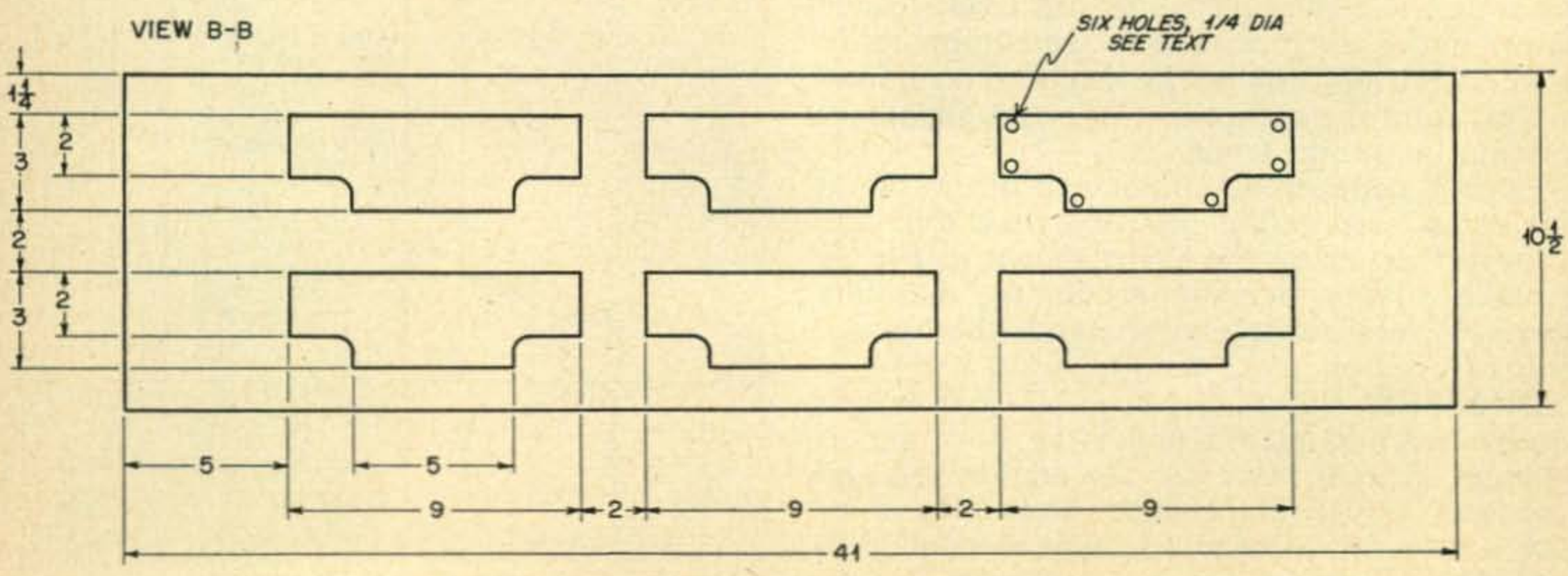
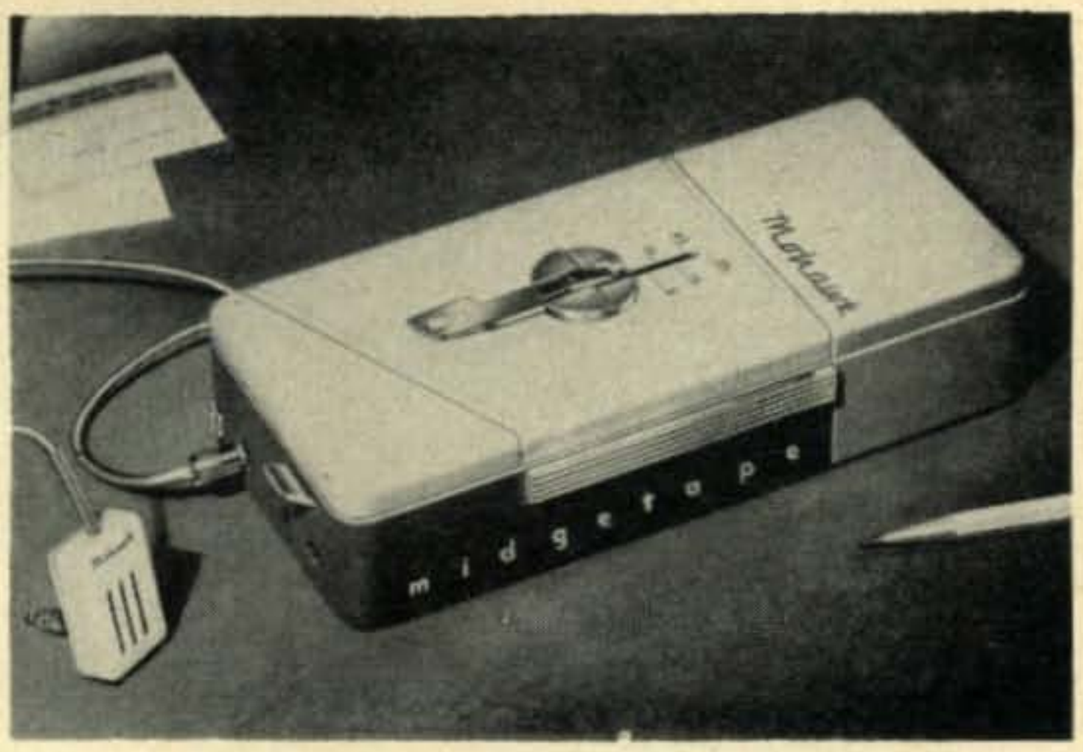


Fig. 4. Console "cubby-holes," detail.



The Mohawk Midgetape

I guess that most of us hams are ripe for anything new in the way of an electronic gadget. A year ago when the *Regency* transistor radio came out I rushed right out and bought one. I showed it around at every ham meeting from then on and found after a while that as soon as I would pull mine out so would several of the other fellows. By now there are enough of these things around so we have planned a couple of articles for transistor converters designed to clip onto the end of the *Regency* for pulling in the ham bands.

But, as usual, I digress. A month or two ago I began seeing small advertisements for a midget tape recorder. This was just the sort of thing that I had been expecting to see for quite some time, so I wasn't too surprised. All the portable tape recorders that have been around before were pretty bulky, but this one was the size of a camera.

I think all of us have savored the idea of being able to have a tape recorder with us wherever we go and make recordings on the sly. Outside the obvious business applications of such a thing I was interested in traveling around and getting a sound picture as well as Kodachromes of the people and places I visited. I wanted to capture things like the amazing accent of two Brooklyn school girls talking, the twang of the New Englanders, voices of friends, Coney Island barkers and Merry-go-rounds, and hundreds of other sounds of our times.

So I bought a *Mohawk Midgetape*. The unit looks just like a camera in its leather case and can be easily operated by the flick of a finger without arousing notice even when talking with someone. It is indeed candid. A small leather case is available for the microphone and in my case I hung this on the recorder strap so it looked like a light-meter case. The mike wire then can be kept in the mike case and the mike clipped to the recorder strap.

During my week-long visit in St. Thomas, which you will read more about in the editorial column, I recorded interviews with W2ZSP and VP2VA (both met on the streets of St. Thomas), talks with natives in the market place, street noises, songs of small hitch-hiking school children offered spontaneously, several calypso songs and many other fascinating sounds. Friends have shown more interest in these sounds than in the stack of beautiful slides that I took of the islands.

Technical details: The *Midgetape* runs entirely on batteries, one for the motor (about 45 hours life) and one for the electronic section (about 100 hours life). The motor battery is a special one made by Mohawk, the amplifier battery is standard.

The one catch to this deal is the price, natcherly. The recorder costs about $250, then you start buying accessories. Considering it as a hobby it is really pretty reasonable, though, for there are few hobbies where you can get the last word in equipment for so little. For business the price means nothing. The convenience of being able to dictate letters wherever you are, record phone calls, private conversations, etc., can be of great value. Ideal for blackmail.

The *Midgetape* uses the standard size tape, but has it mounted in a special cartridge for easy loading. The speed is 1⅞ i.p.s. which gives you 30 minutes of recording on each side of the dual track. A calibrated slot shows you how much tape you have left at any time. Rewind is by means of a hand crank which folds out of the way normally. Playback can be made with the earphone which comes with the recorder or thru an accessory amplifier.

If you are interested in more information on this device why not drop Mohawk a note and let them brainwash you with their literature? Write Mohawk Business Machines Corp., 944 Halsey Street, Brooklyn, N. Y. Mention *CQ*, eh?

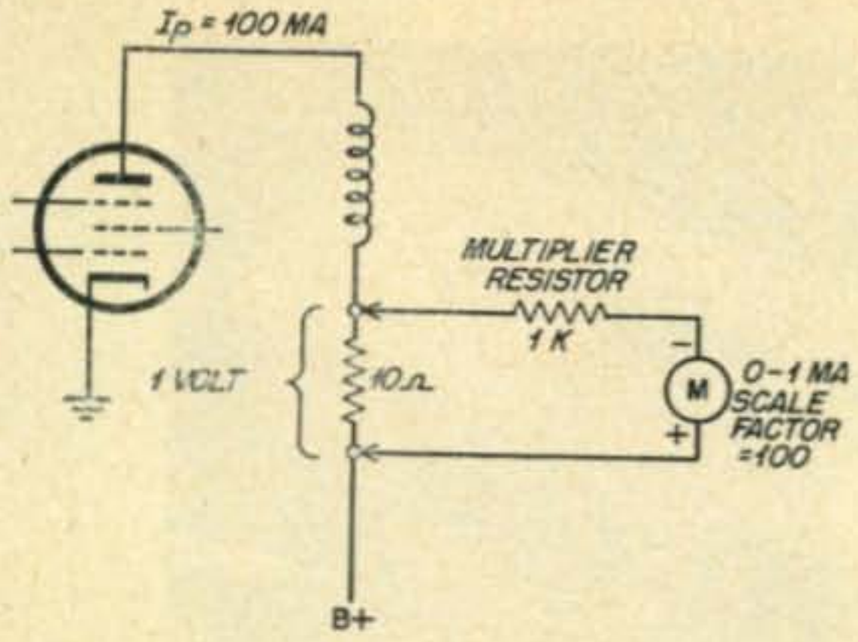


Fig. 1. Typical application of 0-1 ma. meter as voltmeter. Circuit shown is for 0-100 ma. (1-volt drop across 10-ohm resistor)

William J. Vette, W4SWI
Box 572, Key West, Fla.

EASIER METERING..... for Amateur Transmitters

Have you ever looked over the design of a transmitter full of ideas you liked—had most of the parts for building it—then started scratching your head over the problem of providing weird values of fractional-ohm meter shunts? .92 ohms! .047 ohms! .013 ohms! This can make you long for the "good old days" when a ham metered all circuits individually, using as many meters as he could afford. The problem of accurately calibrating odd-value shunts for today's more compact rigs with a single switched meter can be a real sticker, unless one has access to a good bridge. Even then, with such low values of shunt resistance, the switch contact-resistance becomes part of the shunt circuit, and can introduce appreciable error.

These problems need not bother you, for here is a meter switching system which is the acme of simplicity, easy to use, accurate, and requiring only standard stock resistance values

SWITCHED VOLTMETER METERING SYSTEM APPLIED TO A REPRESENTATIVE THREE-STAGE PHONE TRANSMITTER IN WHICH OSC Ip, BUFFER Ig AND Ip, FINAL Ig, Isg AND Ip, AND MOD. Ip IS READ.

Fig. 2. Transmitter Metering Circuits

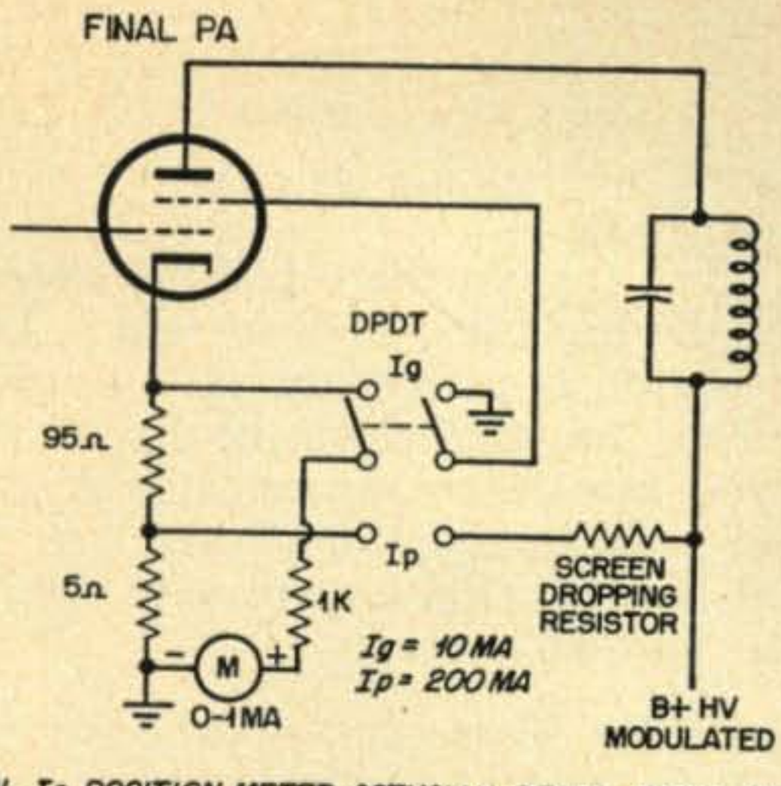


Fig. 3. Circuit for metering used in author's mobile rig permits plate and grid current reading plus VFO spotting

which should be easy to obtain from any parts house. It can be put to use in any transmitter. All that is necessary is to use a low range milliameter (preferably 0-1 ma.) as a voltmeter, with a series multiplier resistor, reading the voltage across a low value resistor in the circuit to be metered (Figure 1). Meter as many circuits as you wish—you are limited only by the number of positions on the switch and by your resistor stock!

If a 0-1 ma. (1000 ohms per volt) meter is used, with a multiplier resistor of 1000 ohms, one volt drop will be required to give full scale deflection. The resistance to use in the metered circuit then should be such as to give one volt drop with the desired full scale current flowing thru it. Resistance values which permit scale factors allowing easy multiplication of the basic scale should be selected, such as for factors of 10, 20, 100, etc. For example, in some grid circuits, a 10 ma. scale would be handy—this would require that the circuit resistance should be 100 ohms. 10 milliamperes thru this resistor would give a full scale reading of one volt; less grid current would give a proportionately smaller reading. A 10 ohm resistor would give a full scale indication with a current of 100 milliamperes, 5 ohms, 200 milliamperes, and so on. Don't worry about the extra voltage drop this system causes in the circuit—most transmitter circuits can surely stand the loss of one volt!

Ignoring the meter resistance, which, for the usual 0-1 ma. meter is approximately 50 ohms, introduces an error of approximately 4 to 5 per cent. By carefully selecting the multiplier resistor to a value of resistance equal to the ohms per volt rating of the meter, less the meter resistance, this error can be corrected.

A slight error is introduced when the meter and multiplier resistance is not appreciably greater than the circuit resistance across which it is connected. The error thus introduced is approximately the reciprocal of the scale factor —9% for a scale factor of 10, 1% for a factor of 100, etc. This is the same effect noted when using a low resistance voltmeter to measure voltages in high resistance circuits. It is for this reason that meters of at least 1000 ohms per volt basic sensitivity should be used. Incidentally, this system will work very well with your regular service multimeter, if a panel mounted meter on the transmitter isn't desired. Just bring the meter leads from the switch to a jack on the panel, into which your test meter can be plugged, and set the meter range switch on the most sensitive current range. The ohms per volt rating in this case is determined by the current range selected. (Ohms per volt of any milliameter is equal to 1000/basic sensitivity in ma.)

Using this switching system, the switch contact resistance can be completely ignored, and standard 5% tolerance resistors, readily available everywhere, can be used for the dropping resistors and the multiplier resistor.

Figure 2 shows how the system can be applied to a typical transmitter of several stages. In Figure 3, a simple DPDT toggle switch allows reading of either the grid current or the plate current in the final stage of the author's mobile rig, and, when in the grid current position, cuts off plate current, for VFO spotting, etc. In Figure 4 you have a more elaborate circuit for use in a mobile transmitter, allowing filament and plate voltages, RF output voltage, and the usual plate and grid currents to be monitored.

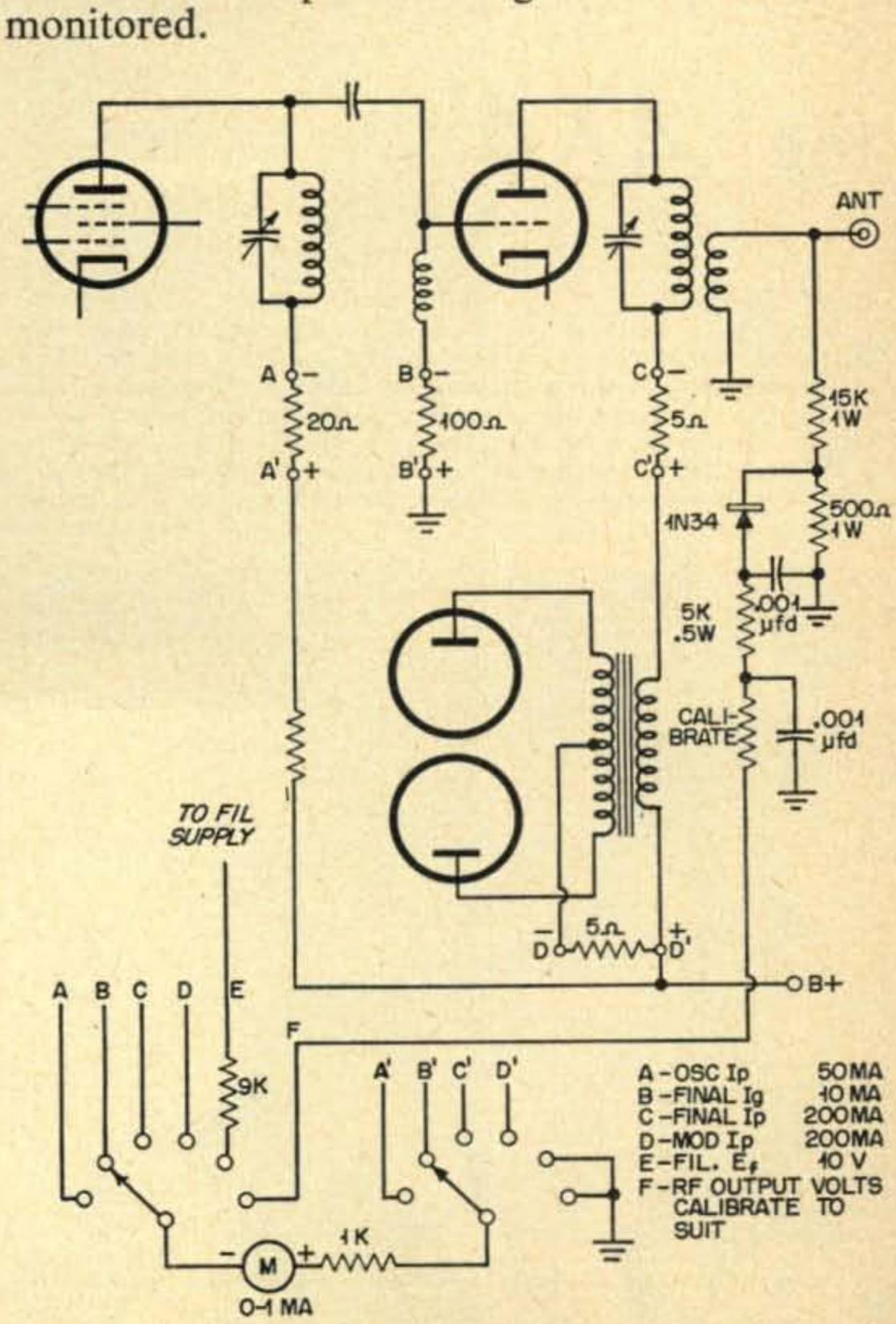
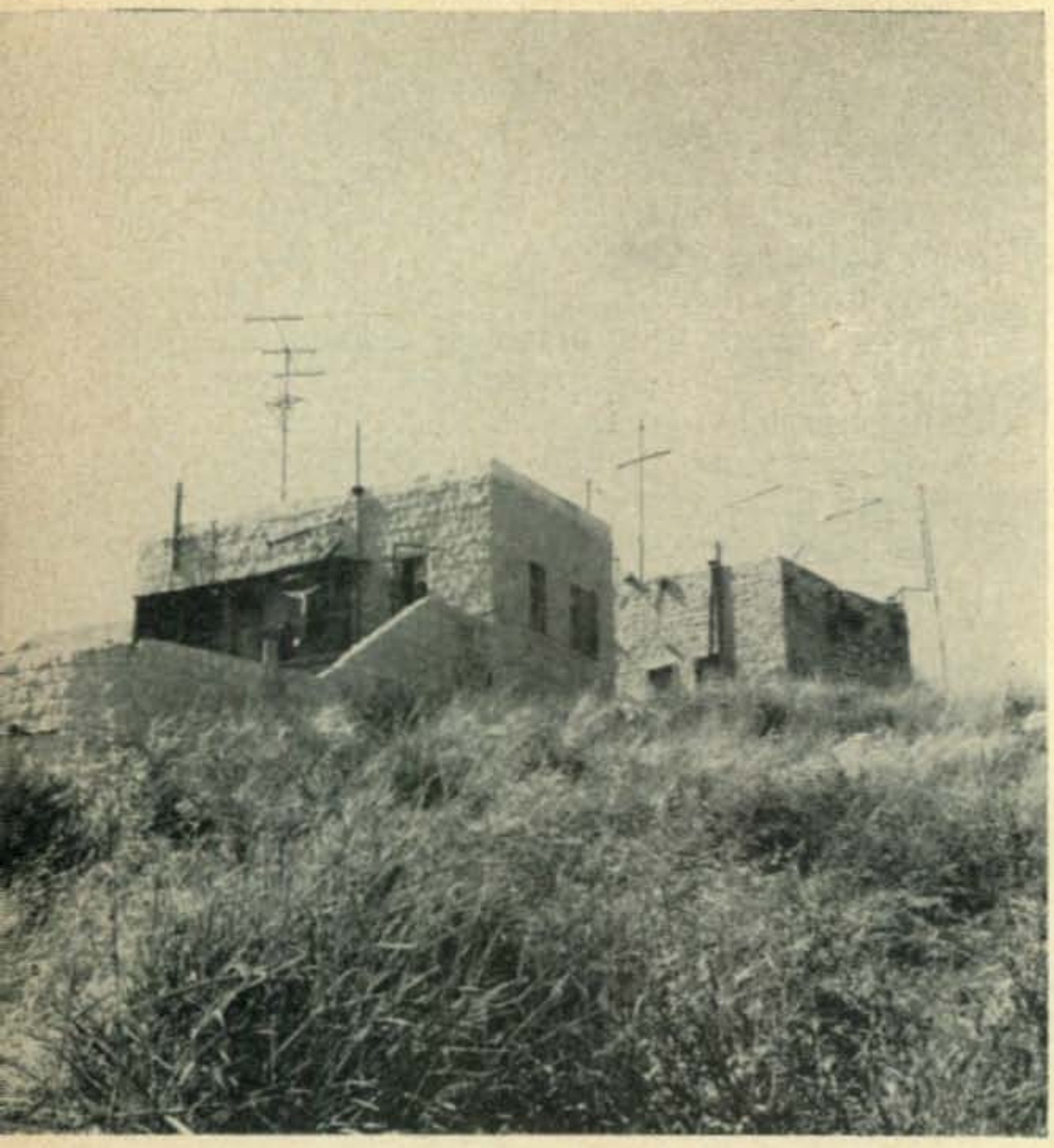


Fig. 4. Complete metering for a Mobile Transmitter.



you've been seeing the 4X4 prefix much lately amongst contest high scorers. OE13USA gives us a picture-story of his visit with the lively Israeli gang—

the 4X4's

Dear Wayne,

Here is a spread of Israeli photos which you might edit and run along with the one of the 4X4=16 certificate.

These photos were taken by Marty Gooen, K2IXD/-OE13USA, during his recent trip to Israel where he was wined, dined and royally treated. He describes his trip as a "wonderful experience" in which every minute of his trip was covered by activities planned by the 4X4 gang.

Dick Spenceley

Radio 4X4FV

Located in the Northern Galillee atop one of the highest QTH's of Israel. The radio station is part of an agricultural settlement founded near the Israel-Lebanon border by Americans. A ZL Special and rotary Mini-Beam are used for 20 meters. Dipoles are used for 15, 40 and 80 meters.

Mr. FV (Bill Silverman) says he is waiting for the 15 meter beam to be shipped from the States. The station, active less than a year, has already worked over 100 countries. Input is between 30 and 45 watts—depending on the source of power at the time.

Certificate offered by I. A. R. C., 4X4BX, P. O. Box 4099, Tel Aviv, Israel.

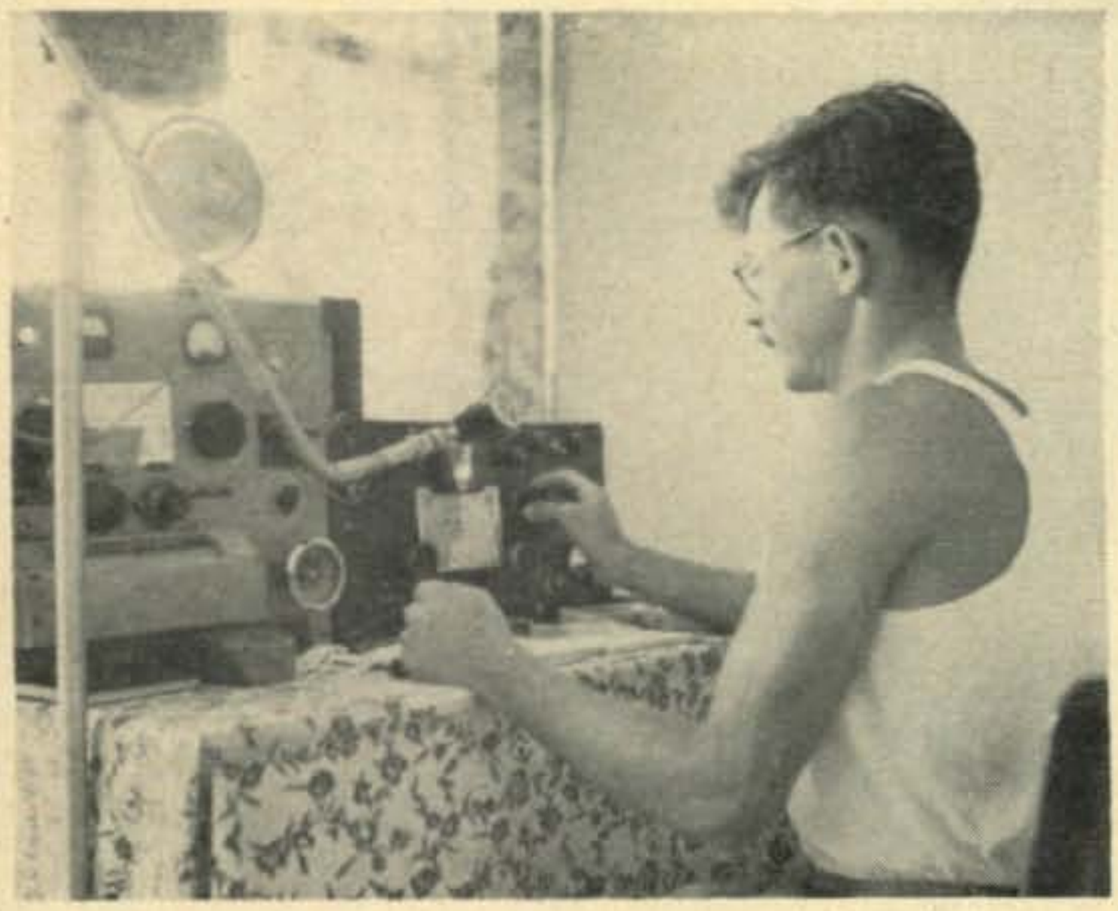
Attached is a photo of the 4X4=16 certificate presented to me by 4X4BX. Requirements for obtaining this certificate are to work 16 4X4 stations on at least 4 separate bands. The total of 16 stations may be worked with any type of emission. Note: Working the same station on 2 bands does not count for 2 credits. There must be 16 different stations worked.

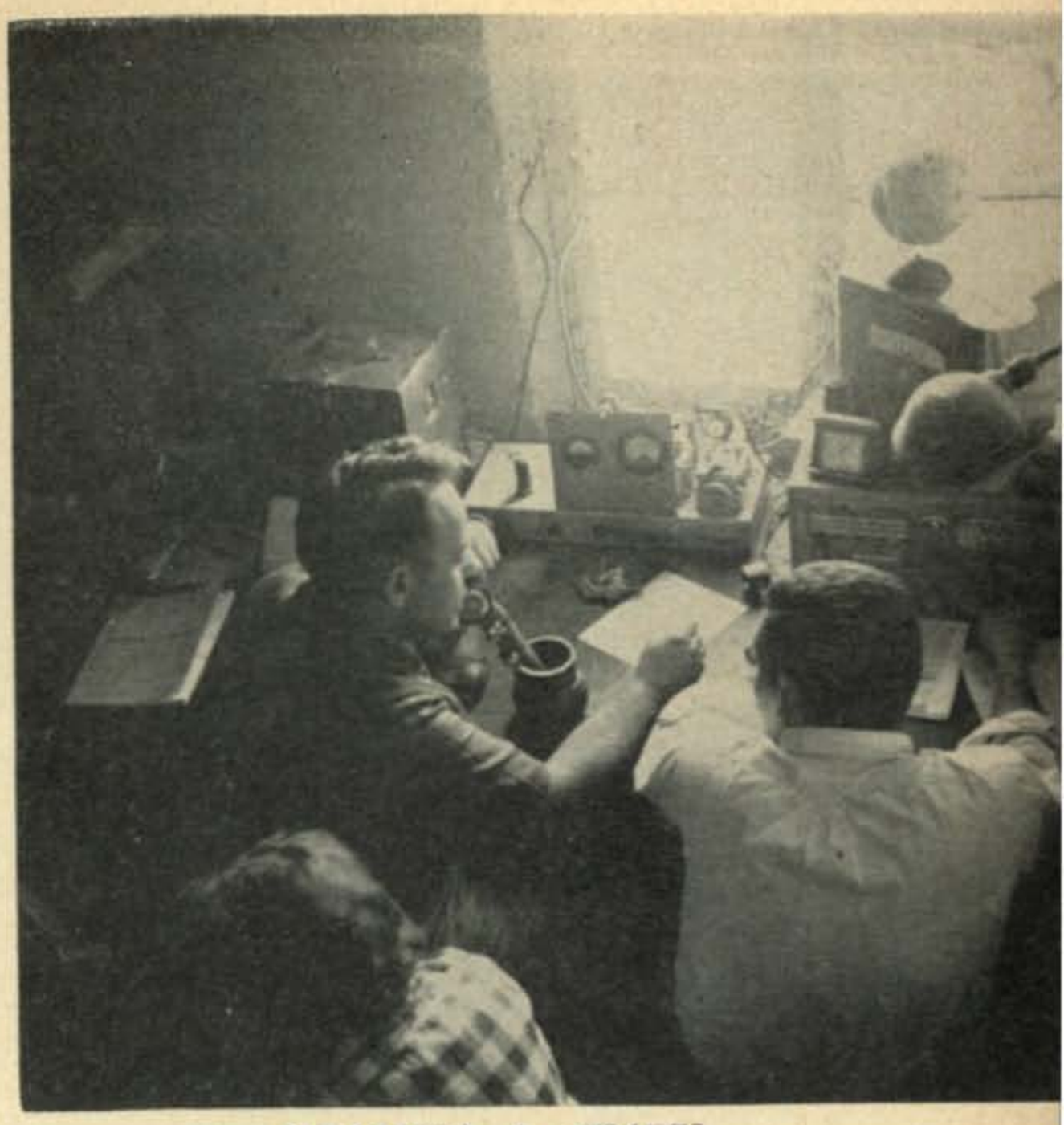
4X4BL

Outside BL's shack in Kibbutz, Ayanot, we have from left to right: Srulik & Jussele from 4X4FV's QTH (they took turns in driving me around the country), Tzvi himself and his neighbors Eli & Miriam—4X4BJ. In the background is his two element beam for 15 meters.

4X4BL—Tzvi

Not far from Haifa is the settlement of Ayanot. There of course you'll find Tzvi who is an advocate of the 15-meter band. A long wire antenna for 20—a 2 element beam on 15—a BC342 receiver and a 25 watt xmitter make up BL's rig. While Tzvi works 20 he prefers 15 and of course works Stateside exclusively on 15.





OE13USA & 4X4FV

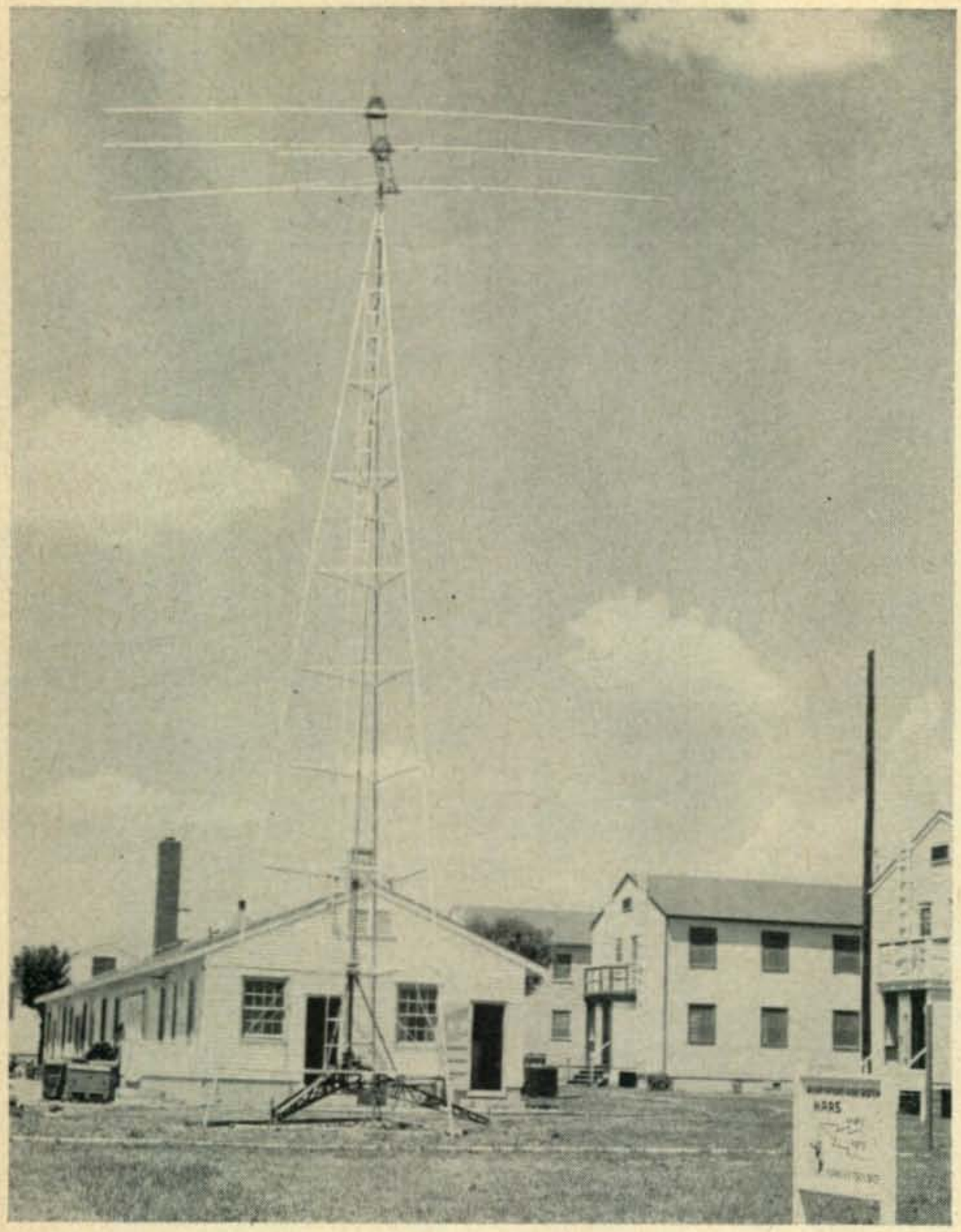
Inside the shack during the nite of the party. Bill (on the right side of the picture) arranged for me to say hello to many of the stations who I used to work regularly. I even managed to keep a couple skeds with my own station back in Salzburg. The receiver is a NC-98. Plans are now being made to build a transmitter with about 100 watts input.

4X4BJ—Eli

In a suburb community outside of Haifa, Eli demonstrates his 25 watt rig which is hidden inside of a piece of furniture. His newly acquired XYI Miriam finds this hobby most fascinating. A BC348 receiver and a ZL special for 20 meters make up the rest of BJ's rig. When the console closes up—no one would guess that it houses the usually strong signal of 4X4BJ.

4X4AS—Shlomo

Down in the city of Rechovot—not far south of Tel Aviv, I had the opportunity to visit one of the most powerful stations in Israel. An ART-13 XMTR with 200 watts input and a BC-348 receiver make Shlomo's station difficult to beat over there.



A windmill tower and a 20-meter rotary beam are used to bat the breeze by Forbes AFB hams

WHAT IS MARS? The average person would probably answer that it is a planet, or a candy bar, or a toy manufacturer, but wives of men on temporary duty in Alaska from Forbes Air Force Base, Kansas will tell you that MARS is the Military Affiliated Radio System.

Forbes wives know about the system, because many of them have talked to their husbands in Alaska through its facilities. Over approximately 3300 miles, as the crow flies, the magic of amateur radio brings them the voices of their loved ones. Among wives who have had opportunity to use the service one expression is common. "It's wonderful."

When the two RB-47 wings departed Forbes on TDY (Temporary Duty) in May, the amateur operated station on base was almost ready to set up communications with MARS stations at the TDY sites. At the time it was hoped a working plan could be made for both the wing in Alaska and the one in French Morocco. However, French authorities seriously object to third party traffic on amateur frequencies in French territory.

Early in April, paperwork was initiated to obtain a new antenna, necessary for successful contact with Alaska. On May 20 the station received a windmill tower from Mr. Frank H. Lukert, a farmer near Topeka. The tower was put into place on June 7, and work preparatory to the installation of a 20 meter rotary beam was begun. The beam was attached to the top of the tower and first used on June 16. Since that time there have been many conversations between Forbes and Alaska, and Bill Weir, a Topeka Journal reporter, completed a successful radio interview with a sergeant in Alaska for a feature story.

What does MARS do? The wives would probably tell you it lets them talk to their distant husbands free of charge. It would be a true answer, but to consider this aspect alone would be to look at the edge of the picture.

MARS stations are operated by licensed amateurs in the military service to serve as emergency communications for installations and disaster stricken areas near by. Many military installations have mobile units in addition to their fixed stations. These units are kept ready to be dispatched to any location in which they are needed.

By GEORGE E. FLEMING
Forbes Air Force Base
Topeka, Kansas

The "Drooping Doublet" Antenna

Richard F. Van Wickle, W6TKA

1161A Irving Avenue,
Glendale 1, California

It's comparatively easy these days to build a transmitter, measure its output, reduce the harmonic content, then get on the air. Transmitter performance is something that can be visibly and aurally determined with relative accuracy, right in the shack.

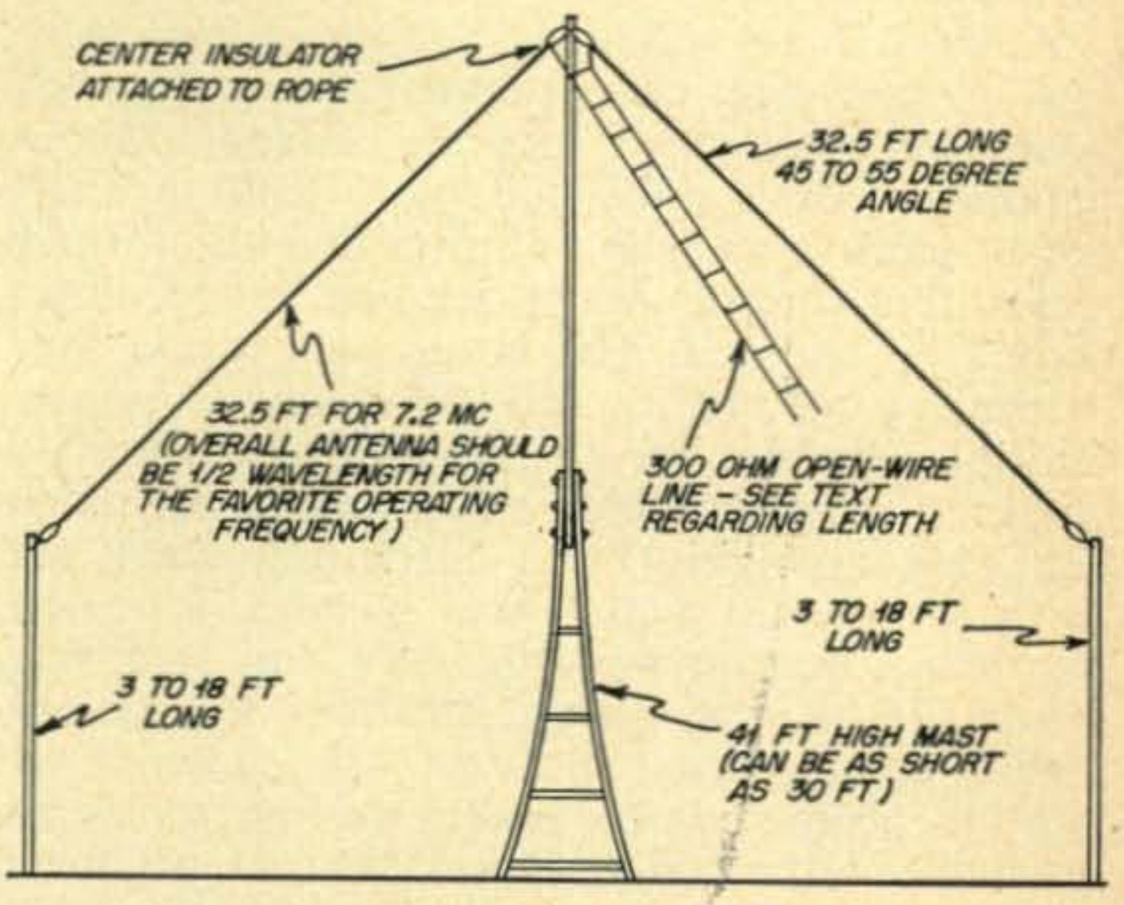
Antennas, however, present the problem of dealing with a great number of variables. Angle of radiation, ground wave, skip and radiation efficiency are all variables, and sometimes unknowns. A dipole, for example, may produce excellent results at a given distance. A vertical, or other low-angle radiator, may give good results locally and at distances greater than those covered by the dipole. For this reason it is generally useless to compare your vertical with some near-by ham's dipole, when both in QSO with the same station. One of you will generally get a better signal report, primarily due to the difference in angle of raidiation and directivity, thus leading one of you to believe that the other has a better antenna. True, it may be better for a given distance, but here again antenna work is all relative. It depends upon what contacts you want to make, and at what DX you are shooting.

Enough of this philosophy. Let's get down to cases. The antenna to be described falls into the vertical, low-angle-of-radiation category. It is simple to erect, requires very little space, will operate quite well on its harmonics, may be fed with 300-ohm open-wire or solid-dielectric line, and does not require radials.

It is commonly known as the "Inverted V." This is something of a misnomer, since "Inverted V" actually refers to another and older type of antenna, a sort of "half-rhombic." Just to confuse the issue, we might even call it the "Upside Down, Tilted, Double Vertical." But lets not . . . lets just call it the "Drooping Doublet."

This antenna has been in use, in one form or another, here at W6TKA since April, 1954. It is not original with me. Some time ago I worked another ham, whose call has since been forgotten, who was using a version of this antenna. I put one up, tried different designs and talked it up on the air. Now, at least in the West, there are a lot of them in use. Not that their popularity is all my doing, but I like to feel that I did have something to do with it. The "Drooping Doublet" was originally erected here as a "compromise," when space problems made any other type of antenna out of the question. But it has turned out to be anything but a compromise, particularly on its fundamental frequency—and my particular antenna, cut for forty meters, exhibits excellent performance on eighty, seventy-five and twenty as well.

It is essentially a center-fed doublet, a half wave in length for the lowest frequency to be used. However the forty-meter job will work on eighty and seventy-five. Although those bands are worked only occasionally, the antenna has given a good account of itself. The center insulator is supported at the top of a mast, anywhere from 30 to 50 feet above the ground.



Each quarter-wave leg droops down at a 45 to 55 degree angle and the ends may be supported near the ground by any available support, from three to 12 feet high, depending upon the height of the center mast and the angle of descent of the legs of the antenna. Number 12 wire is used, but for a time we tried number 24 and it worked just as well!

One of the big advantages of this antenna is its meager space requirements. Like most vertical antennas, it is a happy answer for those with small yards. It is one jump ahead of the ground plane, since it requires no radials. An efficient radial system would have been quite difficult in my case when you consider that the complete yard is only 40 by 40 feet, with the house right smack in the middle and occupying at least 75 per-cent of that space. Also, unlike the ground plane, it may be operated on its second, third, fourth and even "sub" harmonics. This is just what was wanted, since space limitations and the landlord's patience precluded the possibility

of more than one really efficient antenna.

In spite of what you might think about the impedance of a center-fed half-wave doublet, this antenna is fed with 300-ohm open-wire line and the standing wave ratio is fairly low. Elementary measurements using the Twin-Lamp method of measurement show the SWR on this particular installation to be between 2 and 3 to 1, which is certainly acceptable. This is the same reading gotten while checking a temporarily-erected dipole constructed of 300 ohm solid-dielectric line. The "drooping" apparently increases the impedance.

No loading problems have been experienced on any of the bands used and there is no RF floating around the shack. Using only 55 and 90 watts input, forty meter 'phone contacts have been made with stations in Hawaii, Canada, and on the east coast of this country as well as many intermediate east, south and central points. This was in the fairly crowded evening and week-end afternoon hours, too. As for twenty meters, equal DX 'phone contacts have been made.

A word here about the length of the feedline. If you refer to a popular antenna handbook and then to a popular amateur radio handbook, both published by a leading amateur organization, you will find that the former states that quarter-wave lengths in feedlines should be avoided. The latter publication says to use, by all means, quarter-wavelengths and multiples thereof for feedlines for "harmonic" antennas, one of which this antenna seems to be. This ambiguity was intriguing so I set forth to see just which was correct. I started out using quarter-wave feeders and had fine results. I am now using a 45-foot feedline and having equally good success. Neither length of line has presented any undue loading problems or changed the SWR appreciably. It becomes more and more apparent the deeper you delve into these things that there can be no hard and fast rules for this, or perhaps any other, type of antenna. It is a little different for each installation.

For example, I've worked a couple of fellows using this antenna who were feeding it with 52-ohm coax, one who was feeding it with 72-ohm coax, and still another who was feeding it with 450-ohm open wire line. And they all reported excellent results. Of course, I like my own installation the best but if you are experimentally inclined here is your chance to have a little fun.

Figure 1 shows the antenna as it is today. The support is an "A-Frame" mast, 41 feet high, constructed of good quality 2" x 2" lumber. A metal TV mast could have been used but, believe it or not, it would have been more expensive than the A-Frame. Its total cost was right around $5.00, including hardware and paint. Also, I wanted to stay clear of all metal objects as much as possible, to avoid resonance and directive effects. The usual "flagpole" (continuous) rope-and-pulley arrangement is used, with the center insulator of the antenna secured to the rope. The ends of the antenna were brought out at approximately 50-degree angles and attached to convenient supports. These turned out to be the corner of the garage on one side and a 15-foot 2 by 2 secured to the incinerator on the other.

Incidentally, for the top guys of the mast 300-pound test plastic clothesline with a rayon core was used.* This plastic line is available in several weights at, among other places, Safeway stores and Sears & Roebuck, at nominal cost. Use of this line obviated the nuisance of placing strain insulators in guy wire at the necessary intervals, since the plastic itself is an insulator and no resonance problems are encountered. When the cost of the clothesline is figured against the cost of guy wire and insulators, you come out even. And if your time is worth anything, you've *saved* money there! However, remember that this is California and although the mast has withstood several heavy winds with ease, I do not know how the line would react in severe winter climates. So perhaps some caution and research is in order for your own particular area.

Conclusion

Only the surface has been scratched in the work with this antenna. It is an outstanding performer just the way it is now, but there is probably a lot more research that can be done. Among other things, I believe that there is some definite relationship between the angle of the quarter-wavelength legs of the antenna and the angle of radiation, as well as various effects of the overall height above ground. Further work is planned along these lines, including tests to determine: (a) if a counter-poise beneath the antenna, running horizontally from one low end of the antenna to the other, would effect any improvement and (b) if leaving one low end of the antenna fixed and varying the height of the other low end would have any effect on the directivity of the antenna. Preliminary investigation has not disclosed any improvement or change from either of the above arrangements, but further tests will be conducted.

As you can tell, I am quite enthusiastic about this antenna, simply because of its excellent results. I would appreciate hearing from any one else who has done work with this antenna and might be conducting experiments either in a similar direction or divergent from mine.

Let me emphasize again that I do not claim credit for "inventing" or discovering this antenna. It had seen limited use for some time before I heard of it. I simply took the idea, played around with it, and have recommended it highly for all those interested in working "out of their backyards." It's easy to build, so why not give it a whirl?

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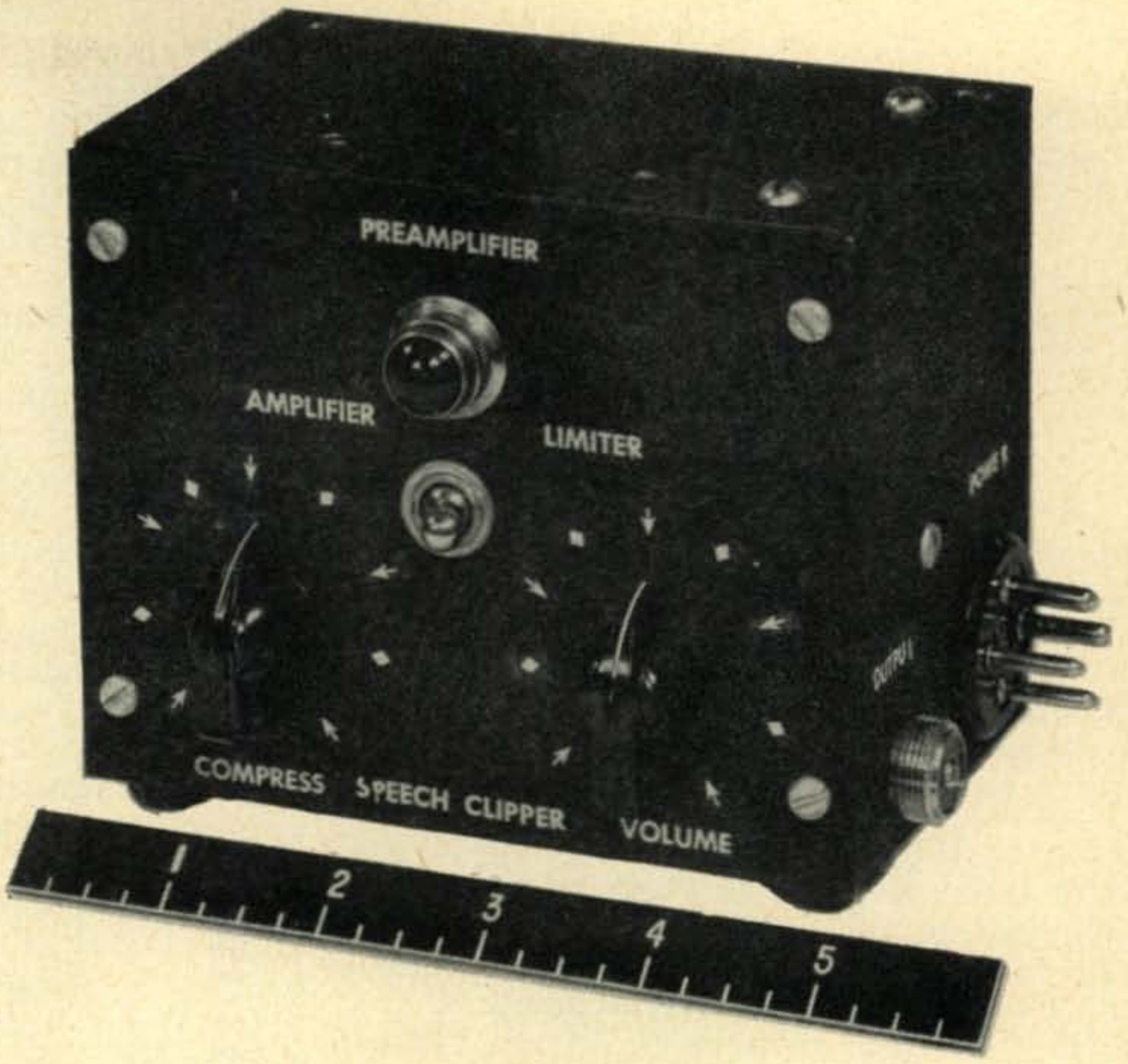
*See *Guys and Halyards*, CQ April, 1955, p. 24



This tiny unit performs the functions of preamplifying and voice-range filtering, with clipping controllable by a panel switch

Preamplifier Speech Clipper

Richard E. King, W4NXJ/2

Theory

The advantages of speech clipping should be quite well known by the old-timer but for the sake of the newcomer to amateur radio, a brief theoretical explanation is in order. To understand the advantages of speech clipping, one must first understand the principles involved in amplitude modulation.

When an r-f carrier is modulated 100% by a sine wave voltage, the energy contained in the radiated wave is 50% greater than the carrier power alone. For example, a 200 w. r-f carrier modulated 100% by a sine wave signal would have a radiated power of 300 w. The additional 100 w. are contained in the audio component or sidebands. If this same carrier of 200 w. r-f was modulated 50% by the same sine wave signal, only 25 w. would be contained in the audio component.

Fig. 1 is a graphic presentation showing how sideband power varies as percentage modulation varies. It is interesting to note how rapidly sideband power decreases as the percentage of modulation decreases. To obtain maximum power in the audio component of the radiated wave, the modulation must be maintained at 100%.

Although 100% modulation is desirable, overmodulation must be avoided. Modulation

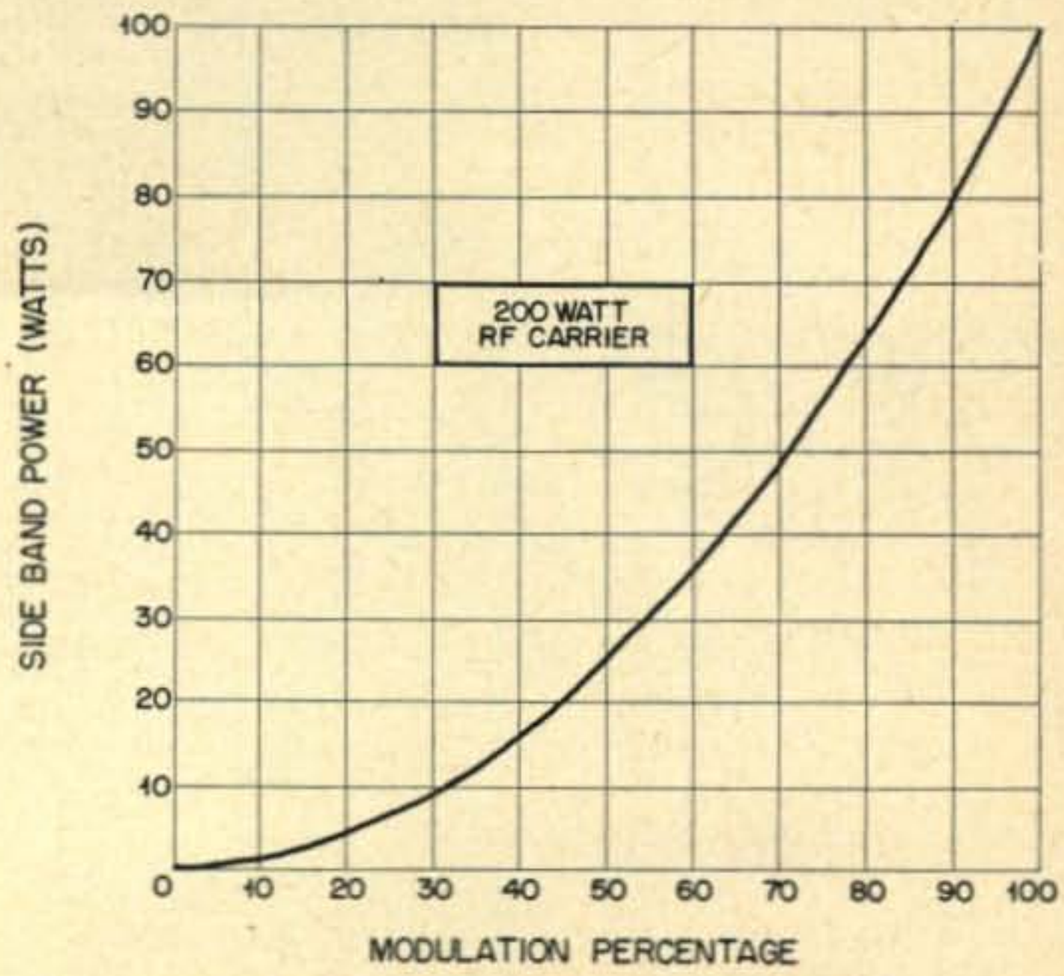


Fig. 1. Audio Power vs. Modulation % (for sine wave).

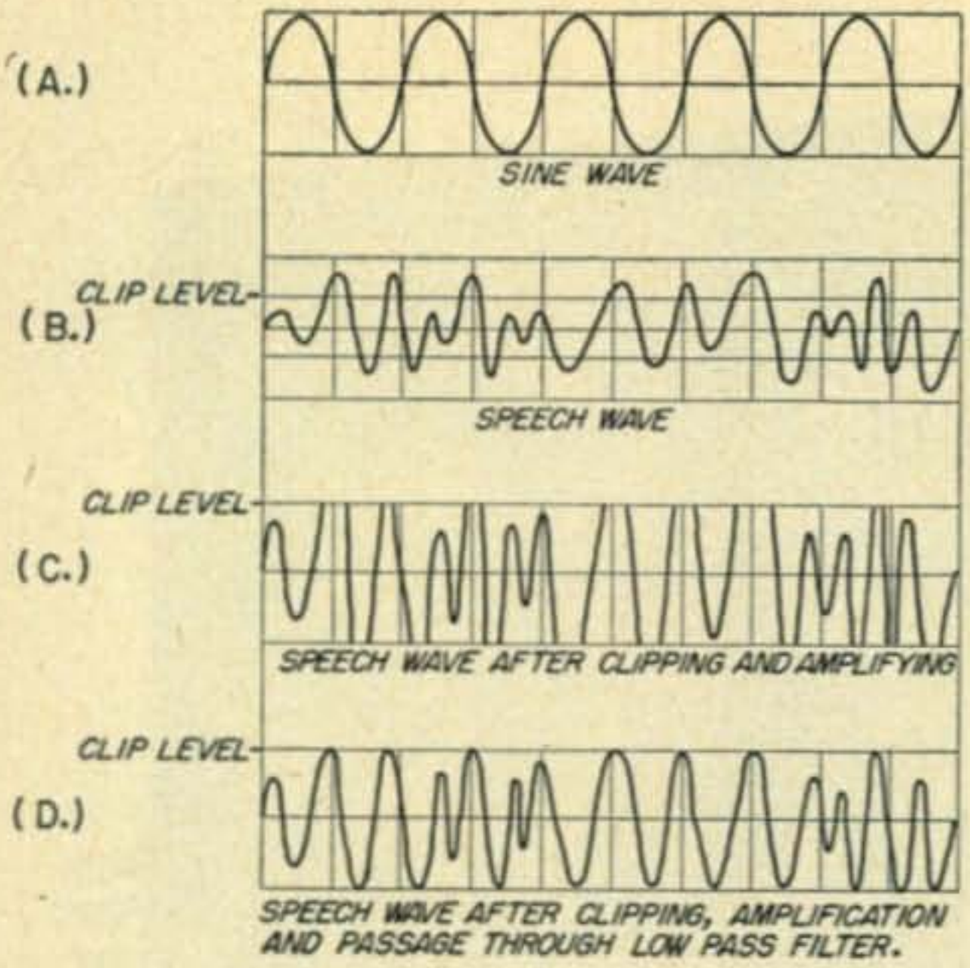


Fig. 2. Significant stages in improving the "heft" of the modulating signal.

in excess of 100% results in carrier cut-off on negative audio peaks. High order harmonics of the modulating frequency are produced that greatly widen the bandwidth of the radiated signal. Even with slight overmodulation, the bandwidth increases as much as 5 times. Therefore, to prevent splatter, modulation must never be allowed to exceed 100%.

Up to this point, only sine wave modulation has been considered. Let us compare a speech wave with that of a sine wave. Referring to *Fig. 2*, (a) and (b), it can be seen that the average power in a sine wave is much greater than in speech. It has been found by experiment that a speech wave of the same peak amplitude as a sine wave only contains 1/2 the power of the sine wave. In other words, a modulator, if adjusted to give 100% modulation on voice peaks, only gives an average modulation of 70% compared to a sine wave signal of the same peak amplitude. Using our previous carrier power of 200 w. in *Fig. 1*, the average audio power is now approximately 50 w. It is obvious from the above discussion that some method is needed to increase the power in a speech wave without increasing its peak amplitude.

By utilizing a clipping device that can be adjusted to clip peaks in the speech wave at any desired amplitude, power in the speech wave can be increased to equal or surpass the power in a sine wave of the same peak amplitude. This is true because the low level portions of the wave can be further amplified without causing overmodulation on signal peaks. These peaks are held at a constant amplitude by the clipper and amplification prior to the clipper increases the speech power without increasing the peak amplitude. This can be visualized by referring to *Fig. 2 (c)*.

Once the modulator gain has been set for 100% modulation, it will be impossible to overmodulate the transmitter because the clipper will keep the maximum output at a constant level regardless of the amplitude of the signal applied to it. This is an added advantage of speech clipping.

With light clipping of four to six decibels, audio quality is not noticeably changed; however, with heavy clipping, the naturalness of a voice is lost even though the signal is very intelligible. Clipping produces the same high order harmonics as overmodulation. It is necessary to provide a low pass filter with a cut-off of around 3,000 cycles to prevent these harmonics from reaching the modulator and producing splatter.

Parts List for Figure 3

C1—.02 ufd. 250 v.d.c.
C2—10 ufd. 250 v.d.c. electrolytic
C3—.003 ufd. 250 v.dc.
C4—.01 ufd. 250 v.d.c.
C5—20 ufd. 50 v.d.c.
C6—300 uufd. 250 v.d.c.
C7—.05 ufd. 250 v.d.c.
C8, C9—200 uufd. 250 v.d.c.
C10—180 uufd. 250 v.d.c.
R1—2.2 meg. 1/2 w.
R2—220 K 1/2 w.
R3—500 K potentiometer
R4—100 K 1/2 w.
R5—100 K potentiometer
R6—300 ohms 1/2 w.
R7, R8—600 ohms 1/2 w.
R9—220 K 1/2 w.
R10—200 K 1/2 w.
L1—4.5. Hy filter choke
CR1, CR2—1N34 Crystal diodes
J1, J2—Standard Mike Connectors
P1—Amphenol 4 prong male connector
SW1—s.p.s.t. toggle switch

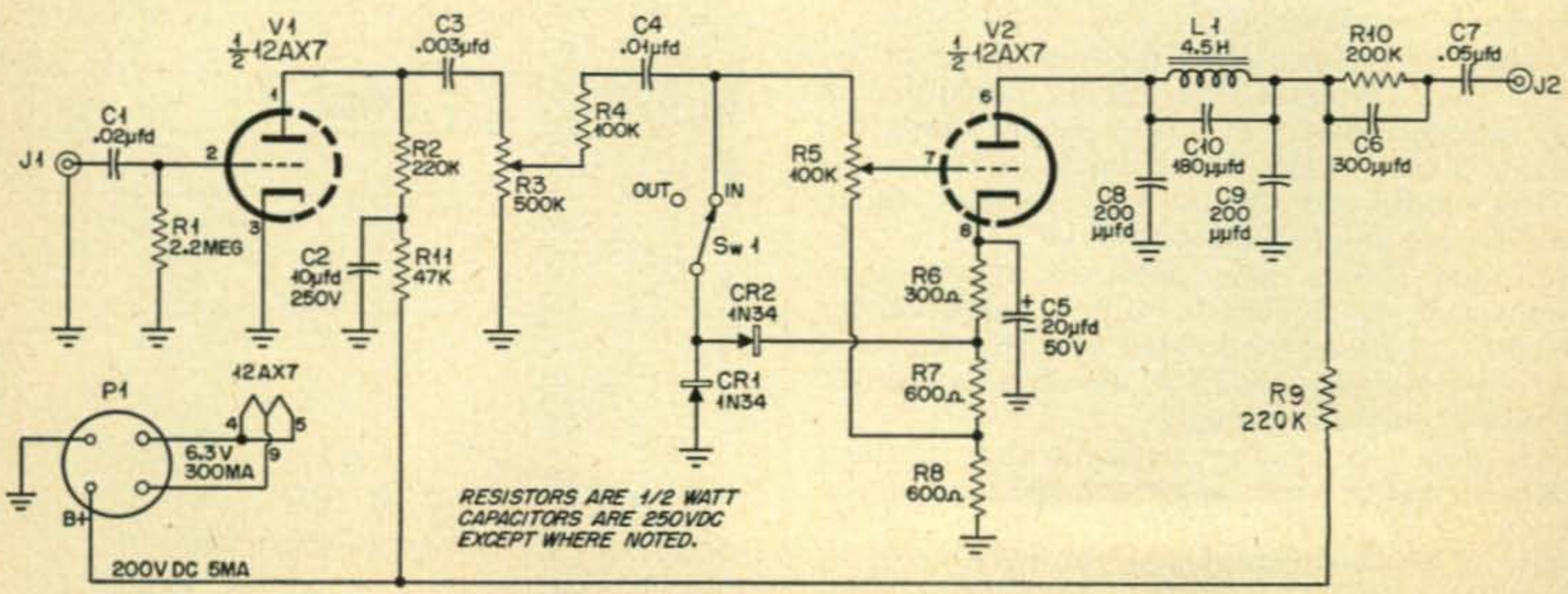
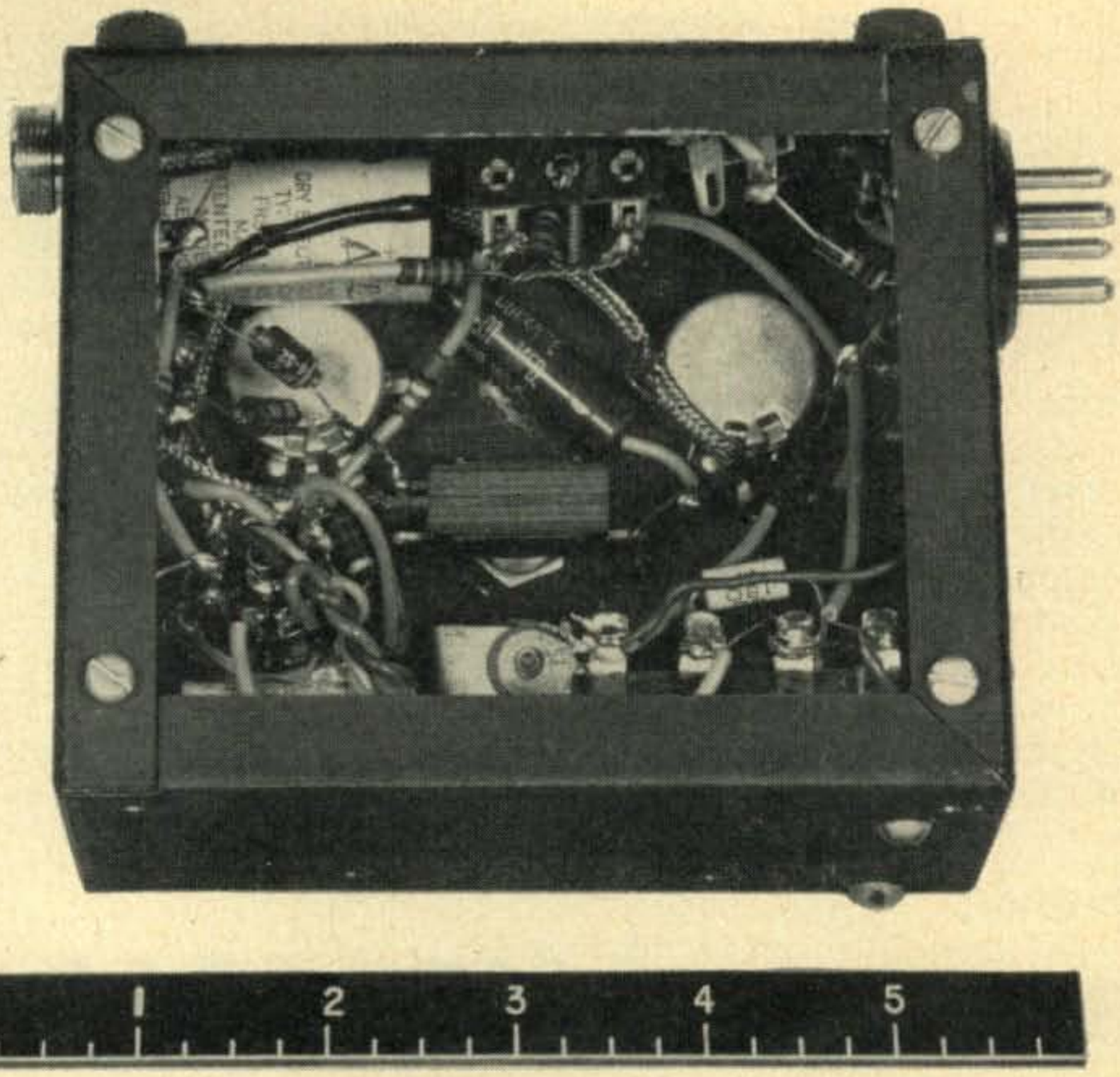


Fig. 3. Preamp-Speech Clipper schematic.



Bottom view showing compact parts placement.

General Description

The unit described here is an effective speech clipper, preamplifier. It contains its own splatter filter and can be used ahead of any speech amplifier or modulator having a high input impedance. It provides variable level speech clipping and preamplification.

The power required by the unit is small, only 200 v.d.c. at 5 ma. and 6.3 v.a.c. at 300 ma. A simple and inexpensive means of obtaining the above voltages is the accessory power socket of most communications receivers. However, at this QTH a small power pack using a selenium rectifier supplies power for the unit.

Circuit Description

As the circuit diagram in *Fig. 3* shows, power is derived through P1, a 4 prong Amphenol male connector. The heaters of the 12AX7 are connected in parallel to allow use of a filament voltage of 6.3 v.

The first stage V1, 1/2 of the 12AX7 duotriode, is a standard triode audio amplifier. The plate coupling capacitor C3 was chosen to taper the low frequency response.

Clipping diodes CR1 and CR2 are held cutoff by a constant bias voltage developed across R7 and R8 by plate current of V2. When R3, the clipping level control, is advanced sufficiently to allow a signal of an amplitude greater than the bias voltage to appear across CR1 and CR2, the diodes conduct and limit the peak amplitude. Further increase of R3 results in increased clipping with the peak signal amplitude being held constant by CR1 and CR2.

R5, the gain control, determines the output of the unit after clipping. SW1, the clipper in-out switch, allows the unit to be utilized as a straight forward preamplifier by removing the clipper.

The low pass filter consisting of L1, C8, C9 and C10, rounds off the speech peaks after clipping, thus preventing splatter.

The R/C combination R10 and C6 gives a rising frequency response to compensate for highs lost due to shunt capacitance of the output cable.

The power supply circuit is straight forward and no comment is necessary.

Construction

The preamplifier-clipper can be built in just about any type of Mini-box, or if you are building a speech amplifier or modulator you

Parts List for Figure 4

C11, C12—dual 16 ufd. electrolytic 250 v.d.c.
L2—4.5 Hy 30 ma. filter choke
T1—Power transformer with 6.3 v.a.c. and 200 v.d.c. output at 5 ma.
P2—Amphenol 110 v.a.c. plug chassis mount type
TM1—4 screw terminal strip
SL1—Selenium rectifier, 5 ma.

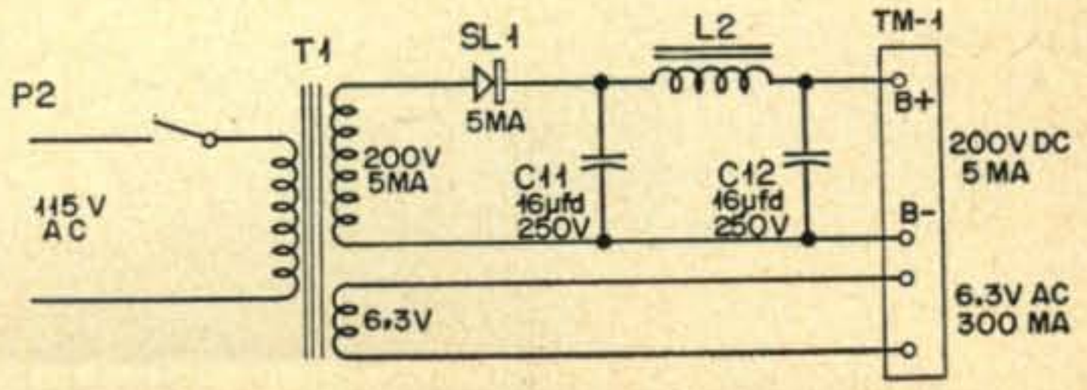


Fig. 4. Simple power supply for Preamp-Clipper unit.

can include the unit on the same chassis.

The unit built at this QTH is housed in a 5" x 4" x 3" Mini-box as shown in the photograph. The operating controls are mounted on the front panel with the cable connectors on the sides. The microphone connector cannot be seen on the front photograph, but is visible on the left side of the box in the circuit photograph.

The 12AX7 tube socket is mounted on an angle bracket as shown in the circuit photograph. The splatter filter is mounted opposite the tube at the lower right.

Filament leads are twisted and kept clear of low level grid leads. Both grid circuit leads are shielded.

Reasonable care should be exercised in locating components to keep as much separation between stages as possible.

The power supply was also housed in a 5" x 4" x 3" Mini-box. No special precautions are necessary in its construction.

Operation and Adjustment

The adjustment of this unit requires an oscilloscope or some other reliable modulation indicator. Procedures for adjusting and analizing patterns will not be discussed here as information is readily available on this subject.

Adjust the limiter control R3 for maximum clipping and talk into the microphone at normal intensity. Adjust gain control R5 in conjunction with the gain control of the regular speech amplifier or modulator for 100% modulation. Once this adjustment has been made, the gain controls should not be moved. The limiter control can now be varied for any desired amount of clipping without fear of overmodulation.

The desired amount of clipping varies under different receiving conditions and can best be adjusted by receiving on-the-air checks. As a general rule, heavy clipping should be used only under adverse conditions, while moderate clipping can be used at all times.

Say, you'd better read this one . . .

Chuck Schecter, W8UCG
Scenic Drive, Muskegon, Mich.

Feeding That Antenna

I think that we will all agree that however good the transmitter or the operator—the station is no better than the antenna system. And, using the same logic, a good antenna is no better than the method used to feed it. We often tell a new ham that he may use any type of rig, but be sure to put plenty of time and effort into making sure that a good antenna is used. How many of us, however, heed our own advice? And, if we do, do we expend a little extra effort to see that the feed-line gets the r.f. to the antenna?

Twin-Lead

Many of us are using the popular receiving-type "Twin-Lead" to feed our transmitting antenna and this works well with low power under certain conditions, even though it was designed and intended for receiving use.

There is also available a transmitting type 72 ohm and 300 ohm "Twin-Lead". This cable will handle a kw., is easy to use and is quite efficient, providing it is kept clean. This is important if one hopes to prevent moisture from affecting the performance. The reason that moisture affects the performance of this type of cable is not that it penetrates the dielectric but that it changes the impedance due to the fact that the dielectric field between the two conductors takes in the air surrounding the insulating material as well as the material itself. Therefore, any moisture on the dielectric becomes part of the dielectric and changes the capacity between the conductors. The characteristic impedance of a transmission line is equal to the square-root of the inductance-to-capacity ratio ($Z=\sqrt{L/C}$). The capacity varies with wire size, spacing and dielectric. The dielectric of Twin-Lead includes the Polyethelyne insulation and the surrounding air and therefore any moisture on the line will change the dielectric constant, thereby changing the "C" factor and thus the impedance. This affect of moisture is smaller on the closer spaced lines and is at the minimum when the line is properly terminated. If your line has a very low standing wave ratio (SWR) in dry weather, then you will experience little change in loading in wet weather.

Cleaning Feed Lines

It is therefore recommended that anyone using this line lower his antenna occasionally and wipe the lead clean. The surface of the line is such that it will remain clean for quite some time. If this is too much trouble then it would be better, from the standpoint of efficiency under all conditions, to use coaxial cable or open-wire feed line even though the latter is a little harder to handle. Losses in the receiving type 72 ohm line per 100 ft. (at 28 Mc.) are 1.9 db while with the transmitting type they are 1.4 db and only .29 db at 3.5 Mc. Remember that every 3 db loss in the feed line (or anywhere else) is equivalent to cutting your power in half!

Coax

Coaxial cable, however, with its reduction of TVI problems is becoming more popular with hams day by day. When used properly these cables make excellent feed lines as proven by the fact that commercial companies use coaxial feed lines exclusively for TV, FM and Police radio—as its losses are very low below 300 Mc. However, as is the case with other solid dielectric feed lines, precaution must be taken to eliminate or minimize standing waves. This is especially important with coaxial cable as one cannot check the SWR with a neon bulb!

Pruning

One way to improve performance (at the higher frequencies) is to "prune" the feed line length so that it is non-reactive at the frequency of operation. While this may seem to be a "make-shift" proposition it is, nevertheless, a means of getting the utmost efficiency from solid dielectric cables as attested by the fact that directions for pruning are included with many types of h-f and v-h-f antennas furnished for police, mobile, marine and other commercial services by many well known companies.

For example, the ideal method of feeding that 1/4 wave whip antenna on your mobile job would be to use coax cable such as Belden or Amphenol #RG8/U. Although your transmitter

may be only a few inches from the base of the antenna you should use about 8 to 10 ft. of cable to feed it. To find the correct length:

1st—With the feed line disconnected tune the transmitter final tank with circuit to resonance **at the desired frequency of operation** and note the setting of the dial.

2nd—Connect a piece of coaxial cable about 3/8 wavelength long to the transmitter antenna link coil (which will probably be about 1 or 2 turns and swung into place in the tank coil).

3rd—Lay this cable out straight and start pruning **very slowly**, keeping the transmitter tank tuned to resonance. When the proper length is reached you will note that the tank will again tune to resonance at **the same dial setting** as before the cable was connected. It is recommended that not more than 1/2" of cable be cut off at one time, otherwise it is possible that you will go by the resonant point without ever knowing it.

When this point is found you will have a non-reactive feed line (with a minimum of standing waves) which will transmit maximum power to the antenna. It is then a simple matter to attach the antenna and adjust its electrical length by the same method so that it too is non-reactive and the whole system "looks" like a purely resistive load to the final tank, which is the ideal condition.

Coupling Factors

The above method of feeding is recommended for any h-f or v-h-f antenna and any type of feed line and when properly used will eliminate the difficulties encountered when trying to adjust only the antenna to eliminate the reactance reflected by both the feed line and the antenna. This will probably account for the fact that many fellows have trouble getting their antenna to "load" and radiate efficiently, while others are using the same type of antenna with good results.

While on the subject of loading it might be well to mention here that it is not a good sign when an antenna (?) loads easily with very loose coupling between the link and the final tank coil. Loose coupling is possible only between two circuits that have high "Q" and a link circuit definitely does not meet this requisite. A "flat" feed line looks like a pure resistance to the transmitter which feeds power to it merely by the transformer action of the tank coil and link. It would be extremely difficult to put power into a low resistance line without tight coupling and anyone who would like to verify this should try to feed power into a nonreactive dummy antenna of the same resistance as the feed line impedance. It can only be done with a properly designed tightly coupled link. Yes, a link should be *designed* and not just happen. It is a part of the transformer that matches the plate impedance of the final tube, or tubes, to the impedance of the feed line enabling maximum transfer of energy to the antenna. Unless the radiation resistance of the antenna is the same as the impedance of the feed line another "transformer" will also be needed here. This is the delta match, "T" -match, "Q" bars or 1/4 wave matching section that happens to be your favorite or the most convenient to use for the type of antenna in question. More on this later.

Link Turns

The formula for figuring the correct number of link turns, assuming unity coupling, is:

$$N = \sqrt{\frac{T^2 \times Z1}{Zpl.}}$$

where: N number of link turns
T number of final tank coil turns
Zl feed line impedance
Zpl plate load impedance of final

If this formula does not seem to work for you look for trouble elsewhere. For one thing, a high "Q" final tank makes for easier antenna loading and increasing the final voltage-to-current ratio will have a tendency to raise the efficiency of the final. Commercial tank coils do not give a good tank Q when used with tubes operating on a low plate voltage-to-current ratio, and will make it difficult to load a non-reactive line. Also commercial fixed or swinging links should be tailored to suit the existing conditions.

Good loading with loose coupling is therefore a pretty good sign that the feed line is reactive and acting as a resonant circuit. Often with this condition the antenna can be disconnected from the feed line and the final will remain "loaded" and sometimes *increase*. Your final should remain at resonance with or without the feed line and/or antenna connected.

Check For Standing Waves

Should you care to check your line for reactance or standing waves it is very simple. Insert an additional 1/8 wavelength of line and check the loading. If it does not change, add another 1/8 wavelength (approximately). If either test has made it necessary to retune or has changed the loading then your line is *not* "flat".

A 2-wire feed line infinitely long would steadily transfer power from the transmitter and would cause no reaction on the output stage. This line may also be terminated in a non-reactive resistor equal to the characteristic impedance of the line and it will perform the same. In the first case the input, output and characteristic impedance are all equal. If, however, the line is short circuited or improperly terminated then a "reflection" will occur and the wave will "bounce" back. Because the reflected wave is out of phase with the transmitted

wave there will be current and voltage additions and cancellations and as long as the frequency is constant these points of maximum and minimum voltage and current will not change position, hence the term "standing waves".

When the terminating resistance is incorrect the power formula $P=I^2R$ cannot be satisfied at the point of termination and little or no power will be absorbed. However we now find points of high current and high voltage along the line. The line has certain current and voltage handling capabilities and if we are to observe these we will not be able to operate at the full wattage rating of the line. The greater the SWR the less power we can put into the line. The SWR is the reason some fellows can run 1/2 kw. to Twin-Lead without trouble while others encounter difficulties with much less power.

Line Reactance: Capacitive or Inductive?

It is possible to determine whether the line is terminated in a capacitive or inductive reactance in the following manner. If the load is capacitive reactive the 1st voltage peak will be less than 1/2 wave from the load and the current peak less than 1/4 wave from the load. If inductive (similar to open-circuit condition) the peak nearest (within 1/4 wave) the load end of the line will be a voltage peak and the 1st current peak will be within 1/2 wave of the load end.

One thing to be recommended to give improved feed line performance is that steps be taken to cancel the coupling coil (link) inductance at the transmitter. This may be easily done by coupling the feed line through a series tuning condenser. One will suffice for coaxial cable but two (one in each leg) should be used with Twin-Lead.

S.W.R.

Standing Wave Ratio (S.W.R.) is the ratio between minimum and maximum line current (or voltage). If the minimum current at any point is 1 ampere and the maximum (1/4 wavelength away) is 2 amperes, the ratio would be 2 to 1. Standing waves not only waste power but also cause BCI and TVI interference (because of radiation from the feed line), reduce the receiving effectiveness of "beam" antenna (through feed line signal pickup), and make the antenna system very narrow in band-width. The band-width increases with proper matching. The main thing is that the *total* line loss be kept below approximately 1 db if possible, and on the lower frequencies a higher SWR can be tolerated. It must be remembered, however, that in order for a line to present a purely resistive load at the transmitter it must be properly matched to the antenna and this cannot be corrected at the transmitter. An antenna Q of at least 8 is required if one expects to be able to couple tight enough to "make 'er load up".

Folded Dipoles

In regard to the use of Twin-Lead cable for the entire construction of a "Folded Dipole" antenna, the following data may be useful. The usual formula may be used (492/f-Mc.) providing 5% is deducted from the final antenna length calculations. In other words the corrected formula now becomes 492/f-Mc. x .95 (95% of the physical length equals the electrical length) or 468/f-Mc. The reason for this is that radio waves travel more slowly in the antenna wire than in free space and consequently a wavelength on a wire will be shorter than in free space.

The velocity of propagation (VP) factor is not used here because in this type of antenna the current in each parallel leg is in phase, the radiation pattern being the same as for the regular single dipole. It is only when the conductors are carrying out-of-phase currents (a transmission line) that the lines of force are *through* the dielectric and it is necessary to consider the VP factor.

The input impedance at the center of the folded dipole is equal to about 4 times the radiation resistance of the regular 1/2 wave dipole (72 ohms) at the same height. This then is approximately 300 ohms when at multiples of 1/2 wavelength above ground.

Height of Antenna

Speaking of antenna height, it is found that the vertical pattern of a horizontal dipole is affected by height and best results will be obtained at about one wavelength high. The vertical half-wave antenna, however, should have its center at about 1/4 wave high for best results. The horizontal antenna will be the best for ground-wave work providing a height of at least 1/2 wave can be attained. On higher frequencies, however, the "ground-plane" type of antenna is extremely effective for local work. One disadvantage of putting up an antenna so high that it would have to be lowered every night to let the moon go by would be that the feed line losses would be terrific—Hi. The maximum usable vertical radiation angle for 20 meter DX will be about 15 degrees and for 10 meters, about 10 degrees.

Matching Devices

In order to match the feed line to the antenna it is often necessary to use some form of matching device. This may be 1/4 wavelength of Twin-Lead, coaxial cable, open wire line or "Q" bars and must be the "*mean*" impedance between the antenna and feed line impedance or $ZT=\sqrt{ZlZa}$. If it is desired to feed a 72 ohm antenna with 300 ohm Twin-Lead: Multiply the line impedance times the antenna impedance (72 x 300) and take the square root of this $\sqrt{21600} = 147$. The "mean" impedance is 147

ohms and therefore 150 ohm Twin-Lead could be used. This must be ¼ wavelength long at the desired frequency *LESS* the VP factor (for reasons mentioned previously). The formula would be 246VP/f-Mc. For example at 29 Mc. the matching transformer would be figured: 246 x .77 (VP factor for 150 ohm Twin-Lead) divided by 29 equals 6.53 ft. or 78.5 inches which will be the correct length. The VP factor for coax cable is .659 and should we desire to match a 72 ohm coax line to the bottom of a ground-plane antenna (approx. 28 ohms) we find that the "mean" impedance ($\sqrt{72 \times 28}$) required will be about 47 ohms. We therefore can use a piece of 50 ohm coax as the matching transformer. Using the above formula (246 VP/f-Mc.) we find the correct length at 29 Mc. will be 5.58 ft. or 67 inches.

Parallel Lines for Impedance Match

It is possible to parallel one or more sections of line to arrive at the desired transformer impedance, but it is recommended that each element be cut from the same spool, as the VP factor will vary slightly from lot to lot of cable. The cable may be cut slightly longer than called for and pruned ½ inch at a time until the desired performance is attained. When paralleling Twin-Lead, it is important that the sections be spaced by the amount of the spacing between conductors. In the case of coaxial cable, sections may merely be taped together. Coaxial cables have the advantage of being easy to install as they do not have to be spaced away from other objects. Being shielded they are of great help in reducing BCI and TVI trouble when transmitting and ignition noise when receiving. Also their operation is not affected by weather.

Stringing Twin-Lead

In regard spacing of Twin-Lead it might be well to mention that it should NOT be tacked to the wall, pinched in the window or taped to other cables or steel mast. In order to perform correctly it should be spaced AT LEAST the distance of the spacing between conductors. Antenna relays that cause a discontinuity in the line spacing also upset the impedance.

Twin-Lead Lightning Arrestor

On a single band antenna ¼ wavelength of Twin-Lead may be used conveniently as a lightning arrestor from the feed line to ground and will have absolutely no effect on antenna performance.

Summing it all up, if you want the most *from* your antenna, see to it that you get the most *into* it.

The data in this article is not necessarily new, but rather is an accumulation of information that often is difficult to locate when needed. (Knowledge is not *what* you know but *where* to find it.)

Using "Out-of-Band" Crystals for the Amateur Bands

Most amateurs use crystals in the lower amateur bands to multiply to frequencies in the harmonically related upper bands. Forty-meter crystals are the usual mainstay for 10, 15, and 20 meter operation in the average crystal-controlled mobile or fixed station.

A check of surplus crystals, lying idle in a drawer because they were not in any amateur band, disclosed quite a few that were usable on the third, fourth, or sixth harmonic. Nothing new or startling, but easily overlooked by many who could use a few extra operating frequencies.

For twenty meters, third harmonic operation of crystals from 4667 to 4783 is satisfactory. Crystals having fundamental frequencies of 4735 to 4766 will multiply into the phone portion of the band.

For fifteen meters, quadrupling from fundamental frequencies of 5250 to 5362 is practical, with the phone band covered by the range of about 5313 to 5362.

On ten meters the sixth harmonic* of 4750 to 4950 will multiply into the phone band and as low as 4667 kc is satisfactory for c-w operation. Also usable are crystals in the 9334 to 9900 kc range on their third harmonic. Phone from 9500 kc up to 9900. Don't overlook possible use of off-frequency crystals on the third, fourth, or sixth harmonic for 11 meters.

Though the fifth harmonics of some crystals would be usable in overtone oscillator circuits, it would require rewiring and tricky adjustment which would not be worth the effort.

So try a little arithmetic with those "useless" crystals. If you don't have some in the junkbox, a look in the current ads will show inexpensive crystals widely available.

*Tripling in the oscillator plate circuit and doubling in the doubler-buffer stage.

Herbert Greenberg, W2EEJ
821 Rutgers Road, Franklin Square, N.Y.

Letters . . . to the editor

Dear Sir:

In regards to that piece "But you can't buy it." You CAN buy it . . . if you know the angles, and don't mind a little white lie or two.

In the first place, no manufacturer has a bookkeeping system or shipping system set up to handle just one item of less than $5 or $10 or more. So they won't bother with the fellow who wants a 13¢ item—as a direct sale.

But if you want it bad enough, write to the sales department of the company for a SAMPLE (implying that if it is O.K. you might buy a thousand). Most manufacturers are glad to pass out samples (if the cost isn't too high) of any new products.

Another way is to find an item being manufactured using the item you want, and write THAT manufacturer for a REPLACEMENT part, implying, say, that Junior just took your hammer and ruined that part in his gismo. In this way you can get almost any specialty part you might want, alhough the price will probably be rather high.

Another thing. Druggists are not chemical shops and chemical supply houses, like manufacturers, are not geared to small retail sales. For chemicals, your best bet is the Chemistry Department of your local High School, College or University, approached through the Chemistry or Physics teacher. They usually have a pretty good stock of chemicals, and are prepared to dispense them an ounce at a time. It is doubtful that you'd be able to buy any Uranium Dioxide, but you could probably get most ordinary acids, salts, alkalies, etc., and if they don't have it in stock, maybe they can cook it up for you.

Metals are harder to get, but as a general rule it is easy to get small items of metal from the users, such as welding and blacksmith shops, tinsmiths, plumbers, machine shops, boat builders, etc. If they haven't got it, they may be willing to order it for you, or tell you where to get it.

Harvey R. Pierce, WØOPA
White Bear Lake 10, Minn.

Dear Wayne:

Heretofore I have been buying *CQ* because I like everything in it, but now I have a bigger reason. I find myself watching for another editorial by Jean Shepherd.

His intelligent talking on subjects from Bugatti to Brubeck, his choice of music, and his "Thurber humor," have won him many listeners who will all term him the coolest disk jockey on the air.

Please get Old Shep to do some more writing for *CQ*.

Tracy Gunderman, K2COL
Elmira, New York

Dear Wayne:

". . . Someone in the Northeastern U. S. is using my call letters on the air illegally. I have received several "QSL" cards showing contacts made with W2EWP on 7 Mc phone. For the information of all concerned, W2EWP is not on the air, has not been since December 1954, and will not be until I return to the U. S. I have advised the F.C.C. completely in the matter. Anyone hearing this "call pirate," who may be in Syracuse, should report the particulars to the nearest F.C.C. office. Apparently someone has read in your magazine that I am in Venezuela and considers my call a good one to "borrow" for a while.

Paul Lee, W2EWP

Inflation

Dear Wayne:

I was reading the November *CQ* and I came across W4YPC's letter to the editor which said he would not buy any more *CQ*'s until the price goes down to 35¢. When the price was 35¢ you just had a little *CQ*, and now since you have this new bigger *CQ*, I think it is worth 15¢ more. I am sending in my subscription for one more year.

73,

Steve Wilson, K6HPZ
Whittier, California

I greatly enjoy the new look in *CQ*, keep up the good work. I think you should remindd some of your readers that by the old price to page ratio they should pay 68¢ for the new *CQ*.

I especially enjoy the editorials and ads by W2*Never*Say*Die*.

VII x XI — IIII

Arvin Congleton
212 NE 16th Terrace
Ft. Lauderdale, Fla.

Phone Patch

Gentlemen:

During the recent United States Independent Telephone Association convention in Chicago, a group of us were having a discussion on "phone patches". . . .

Our company will go all out to help any "ham" make a good phone patch and on several occasions we have supplied the necessary repeating coils and dials so that a good patch could be made.

Very truly yours,

Richmond R. Mann
The Western States Telephone Company
Clayton, Mo.

Club Bulletins

Gentlemen:

We noted the article "Club Newspapers Pay Off!" in December 1955 Issue of *CQ* with great interest. We have had similar experiences with our Bulletin in increasing our attendance and membership. We are, therefore, enclosing a recent issue for you to examine.

We will be glad to exchange our Bulletin with any other club which wishes to do likewise. This offer is being made in order to cement the bonds of amateur radio and exchange ideas.

Motor City Radio Club, Inc.
George Childs, W8UCN, Editor
Detroit 23, Mich.
Ernest M. Cram, W8JXK, Program Chairman

Dear Wayne:

On the 8th of November of this year, it was my pleasure to be a participant in what I consider to have been one of the most novel demonstrations of the versatility of ham radio to date.

While carefully tuning the 21 Mc. fone portions in my everyday search for new countries, I ran across Bert, ZS1SW in Capetown, S.A. I paused slightly while he was tuning up and soon discovered that he was about to test his new 6 meter link with Denis, ZS1B 25 miles away. Zeroing the rig on 21,250, I waited until he called CQDX USA, noticing that he continued to emphasize that stations in the American portion should disregard his call and start giving him a buzz. Shortly afterwards, I became slightly less confused and gave him a shout on the low edge. I signed and listened on the frequency. There was a muffled voice in the background and then he recognized me and asked that I stand by.

As my confusion and curiosity mounted, he repeated the same deal once again until he raised Don, W4HQF, whom I could not copy due to lack of short skip conditions on the north-south path of the east coast. At this point, Bert finally let the facts be known. Denis, ZS1B was tuning 15 with his main receiver and piping it to Bert via a 54 Mc. link. Bert was receiving on six and piping it out over his transmitter which was tuned to 15 meters. Even more interesting was the fact that Denis was in complete control of the 15 meter transmitter at ZS1SW via a VHF link remote control system which they had set up. To demonstrate the operation of this system, Denis cut Bert's 21 Mc. carrier, effectively illustrating the system in operation. Bert then asked me to make a transmission to Don, W4HQF and upon completing it, Don came back with a bang just as if we were in direct contact. By this time I was jumping up and down with excitement, insisting that only one other contact had ever been such fun, that being my first contact upon receipt of my ticket. At this point I chatted with the boys awhile until the breaking stations on my channel began to become more than numerous. Bert recognized W5DNV, WØUNZ, W1VDF and others, and we all chatted and rag chewed exactly as if we were qso'ing direct. I was actually able to hear the other boys' signals exactly as they were being received in South Africa, QSB and all, and it was apparent that they really had rock crushing results. W5DNV in particular, was so loud, even via Africa, over a 20,000 mile path, that he seemed to be in the shack with me.

Wonder if you ever heard of anything to beat this one in terms of novel and interesting QSO's?

Barry, K2IEG/2
Brooklyn, N. Y.

[*Continued on page 106*]

Memoirs of an XYL

Helen Harris, W1HOY

There was a time in my life when I was completely ignorant of such important things as tubes, capacitors, antennas, etc.; also of such names as National, Hallicrafter, Collins, etc. It was at the tender age of twenty that I found how much my education had been neglected. It was at this age that I met my future (in beautiful blond form).

"Ham Radio" was introduced to me in quite a novel way, and at the present time I have finally become convinced that the O.M. was smarter than he looked because of the nature of the introduction. He made it a game and I was one of the players (a gabby one, too).

You see it was this way; Sam's (the O.M.) boy friend was dating my sister, and Sam was dating Helen (me). Joe and Esther, the other couple, took one transceiver (two and a half meters) to the dance hall with them, found a convenient place to connect it and they were on the air. Sam and I took the other transceiver to the beach, found a beach light where we disconnected the bulb, plugged in the transceiver and we too were on the air. We had more fun that way and it was quite some time before we discovered that our conversation was interrupting the P.A. system in the dance hall. It was fun apparently to quite a few others besides ourselves.

No matter where we went we took the transceivers with us and had our own private means of amusement. Of course to the uninitiated we were all a "bit batty" to say the least.

These other incidents that I am about to relate will not be in proper order, as far as their actual occurrence, but what difference does that make to such people who are hard up enough for something to read that they'll even read this.

One of the earliest events of my career as an XYL has stuck with me through the passing years, and is only one in a succession of odd and varied events.

'Twas about the year 1946 when Sam and I decided that the VHF gang from Ohio needed an Indiana contact on two and a half meters. Quite a few of the fellows agreed with us and egged us on to be the ones to go portable in Indiana. As I remember it we didn't have quite the amount of equipment that seems necessary at the present time but we did have all extra space filled. The transformer that I used for a cushion wasn't really comfortable. I just pretended it was to make the O.M. feel less guilty and also because it was either the transformer or me that made the trip to Indiana unless I sat on the thing. You know which one of us would have gone if it came right down to brass tacks. I made it though.

We parked the children with grandma for a week, took the dog with us and finally got away to a slow but determined start. Now was really my first test of endurance (other than the transformer). I always thought that when anyone, even a ham, went on a trip they meant it to be a vacation; stopping to sight-see, picnic, visit relatives, and even have an occasional meal in a restaurant and a night in a real bed. To my amazement I discovered that a "ham radio expedition" was just that and nothing more. I was lucky in one way though. Even that many years ago, besides being a radio fiend Sam was also a coffee fiend; so when the thermos ran dry we did stop to get it refilled. While Sam sat in the restaurant grinding his teeth because of the delay, I rushed into a nearby grocery store and stocked up on everything I could think of which might fill in the empty space in my stomach.

We had decided on Angola, Indiana, as our goal, after spending hours pouring over maps of all kinds of the Hoosier State; as that seemed to be the high point in the northern part. When we arrived in Angola we looked up a local ham (I'm ashamed to admit that I've forgotten his call), and received the information from him as to just where the high point in the territory was located. We proceeded to our destination to find that it was a beautiful cleared knoll, which had at one time been used by the geodetic survey group. At the base of the knoll was a restaurant and tourist home where we inquired as to ownership of the spot we wished to use. Didn't want to get off on the wrong foot right at the start and not knowing if the restauranteers used their radio or TV nightly, we thought it best to make arrangements before

the interference began. We found that the woman who owned and ran the restaurant was the owner of the hill-top too, and although she was not at home we spoke to her brother who assured us that for the small rental fee of ten dollars a night we might have the use of the hill-top. This posed a problem as we hadn't figured on renting the darned hill and our finances didn't run to such fancy prices. We knew for certain that we wouldn't be staying for the week at such a price but figured we could manage a night or two if we drank more coffee and ate less food. The price was agreed on and we shelled out the first ten bucks.

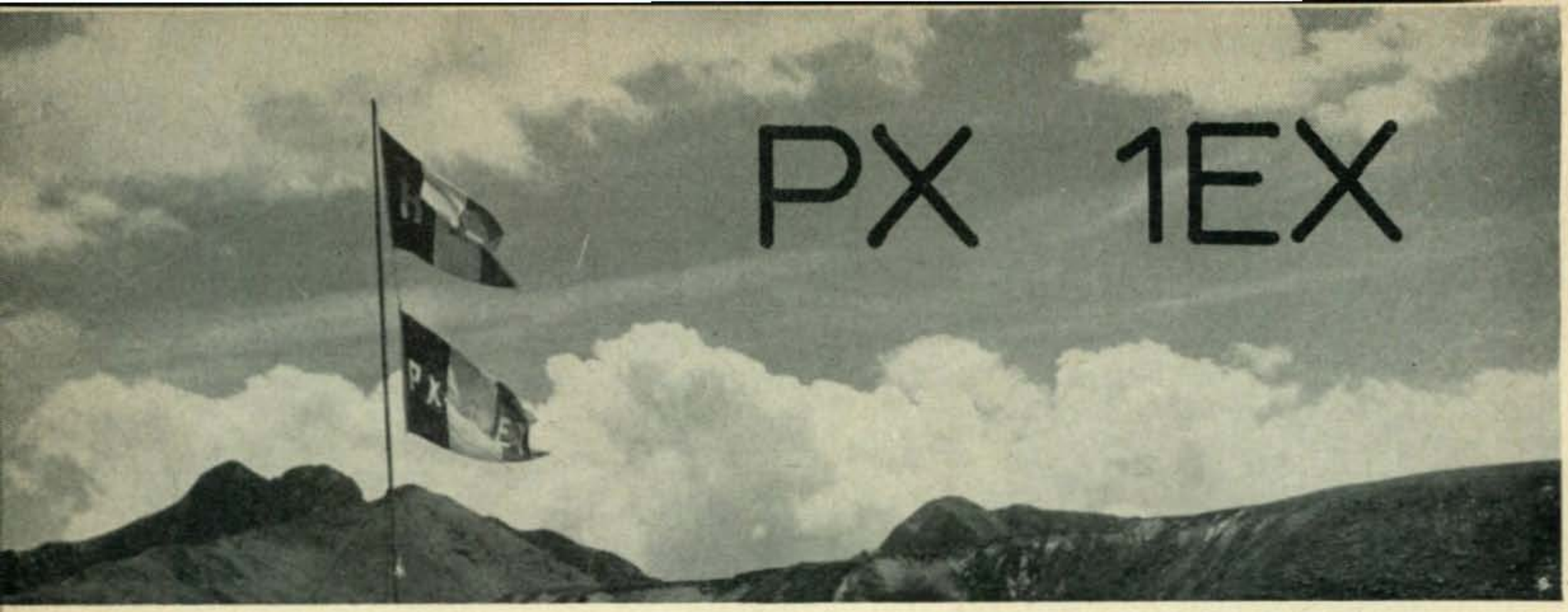
Now began the unloading of equipment. I stated before that it was my first ham expedition so I'm afraid that as far as telling what manner of gear was used I'm still in the dark about that. One thing of which I'm sure is that the transformer arrived safely and that there was a dynamotor along for power. The antenna had been carefully tied on top of the car and for some unknown reason had arrived almost unharmed. There were a few wind burns on it but what can you expect when you're traveling out in the open at eighty miles an hour. I wanted to apply band-aids but Sam warned me off.

The crucial moment was at hand, the antenna in place, the rig all hooked up and apparently in working order and just fifteen minutes till schedule time with Jerry, W8WJC. Then the blow came. Sister, the proprietress of the restaurant arrived with blood in her eye, a good strong right arm ready to swing, and dire threats of the law.

Seems she hadn't been notified of our arrival by dear brother, and also it seemed that she and brother weren't even on speaking terms. What's more, she had neither seen nor heard anything about ten bucks. We just couldn't bring ourselves to the point of offering another ten so I'm afraid that we encouraged the family feud between her and brother by pointing up the fact that we had made the bargain in good faith and couldn't see why she couldn't collect from her brother.

The main trouble was that she apparently thought we were up to something deep and deadly and didn't want her property involved. We talked her into letting us stay until midnight and if we hadn't been picked up by the FBI before that, then she'd believe that we were all O.K. and would give us permission to stay as long as we wanted, but still at ten dollars a night. Of course the poor woman was almost as poorly educated as me and just couldn't see the point in our camping out just to talk on the radio. Oh well, such ignorance can be forgiven I suppose.

It ended up by being a most successful expedition with several contacts into Ohio and we were most happy until we realized that we just might not be able to make it home because of high rentals. By cutting down on both coffee and food we did arrive home but with no Indiana contact for us until another year had passed.



A French Amateur Radio Raid on Andorra

by F8EX

Translated by Gretchen Dambach

The idea of an amateur radio raid on Andorra was thought up last year during the reunion of a group of old friends on vacation. As it was, PXIYR, the only station in that country actually on the air, had because of its "rare DX" (unusual position) some difficulty in satisfying the many QSO demands made of it, and we thought that the idea of giving him a helping hand for a while would be well received by everyone.

There were however a good many difficulties to overcome, because in contrast to previous expeditions of this sort, it was desirable to have everything official and in order.

We decided to make some inquiries, and an interview was given by the Vigier (Magistrate) of Andorra to F8EX and F3IB when they went down in August, 1954. He assured them of his cooperation if a favorable report was given the project by the official technical offices involved.

With this good start, we started to look for a location. The geographical position of the capital city of Andorra la Vielle is not a very good one from a radio point of view, as it is surrounded by hills, and so it was rejected in spite of the advantages it offered (AC—conveniences, etc.). In the end, the QRA decided upon was one of the highest peaks accessible from the Valleys—that of Mata, overlooking the Pass of Port d'Envalira, elevation 8661 ft.

The first steps were thus taken, and after periods of hope and of discouragement, the official authorization finally arrived on July 15, 1955. Preparations were intensified, word of the expedition was sent out to the greatest number of clubs and hams possible, and on the day decided upon, August 7, 1955, those participating arrived from all corners of France, to join forces in Aix-les-Thermes for their entrance into Andorra with flags waving!

The group was as follows:

F8EX, in charge of official clearances, electric power and antennas,

F8EO, who supplied the HF receiver,

F9UK, who supplied the HF and VHF transmitters, the VHF receiver, and the transformers. He was also in charge of maintenance of all equipment during the operation,

F3IB, who took charge of the camp, food, and also QSL,

F3TJ, who acted as his assistant.

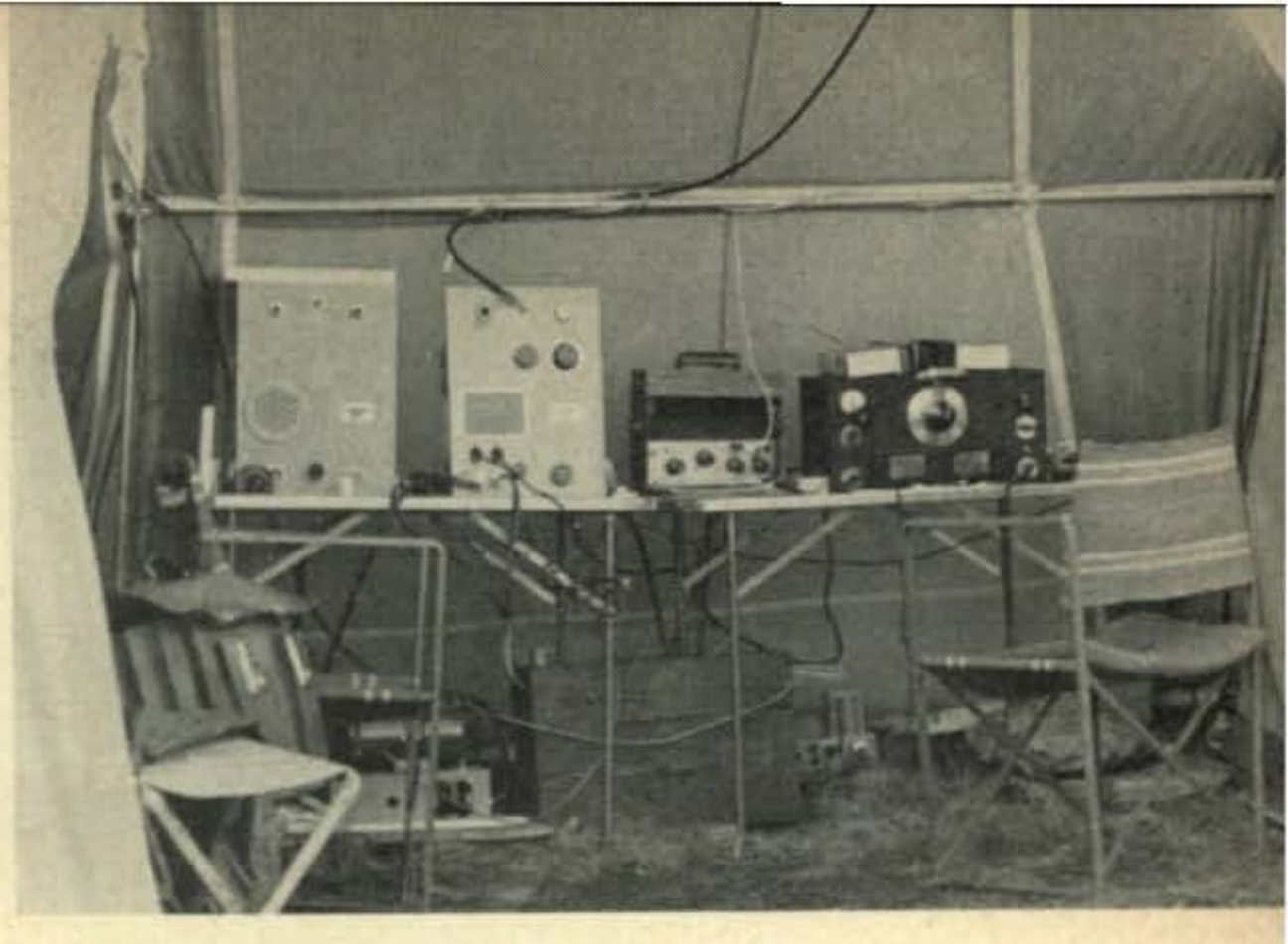
Everyone filled their obligations enthusiastically and well, which enabled us on D-Day to set up a fine and completely self-sufficient camp at 8600′ elev.

And so it was that on the appointed day, in spite of the difficulty of establishing camp in the middle of a fog, the first CQ was sent out at 7:25 p.m., GMT, in the 14 Mc. band, and that LA6U recorded the first entry in PXIEX's log, a log which in six days was to accumulate some 650 entries.

In the h-f bands, we transmitted on 3.5, 7 and 14 Mc. with both phone and CW.

In the v.h.f., a few brief attempts were made without success on 144 Mc., but this was discontinued as the transformer system was shared by the two setups and it meant stopping the h.f. activity. On top of this, it should be noted that in spite of PX1EX's altitude, our location was not very good for v.h.f. transmission, as a number of mountains close by went to over 9000′ elevation and blocked off the signal in the more important directions. No amateur stations were heard and no QSO's made during these attempts.

Conditions for transmission were as a whole not very good—quite poor on 3.5 Mc., fair on 7 Mc., variable on 14 Mc., and zero on 144 Mc. In spite of this it was possible to contact 60 countries on all six continents, all six districts in the United States and Canada with the exception of VE7, French overseas stations on five continents, and a large number of the



French Provinces.

Because of stations wanting QSO with PX1EX, which made traffic extremely heavy, the European QRM was miserably hectic at times; but in spite of this some fine DX's were made:

358 European stations were contacted, of which 117 were F and FOM (France and France Overseas). Also 282 DX stations, of which 220 were W and VE. Some 20 stations could not be counted as they were not clearly identified.

During the night of August 12-13, after a violent storm had all but stopped traffic during the afternoon, reception with North America became remarkably good on 14 Mc., and the station's activity intensified. At certain times it was possible to establish 40-45 QSO's per hour with W and VE stations in all districts.

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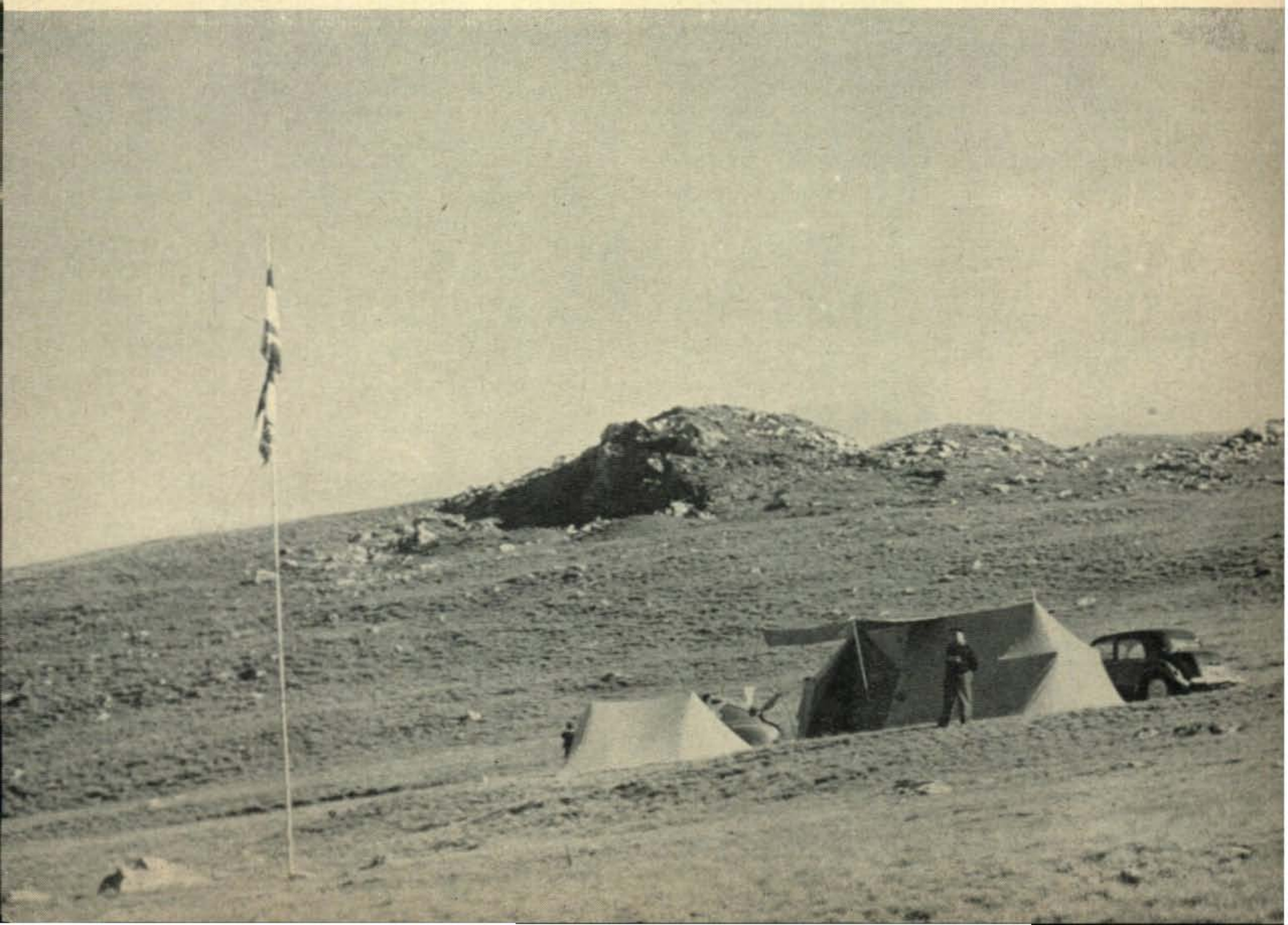


RF Phase Sensing Unit and Impedance Magnitude Indicator

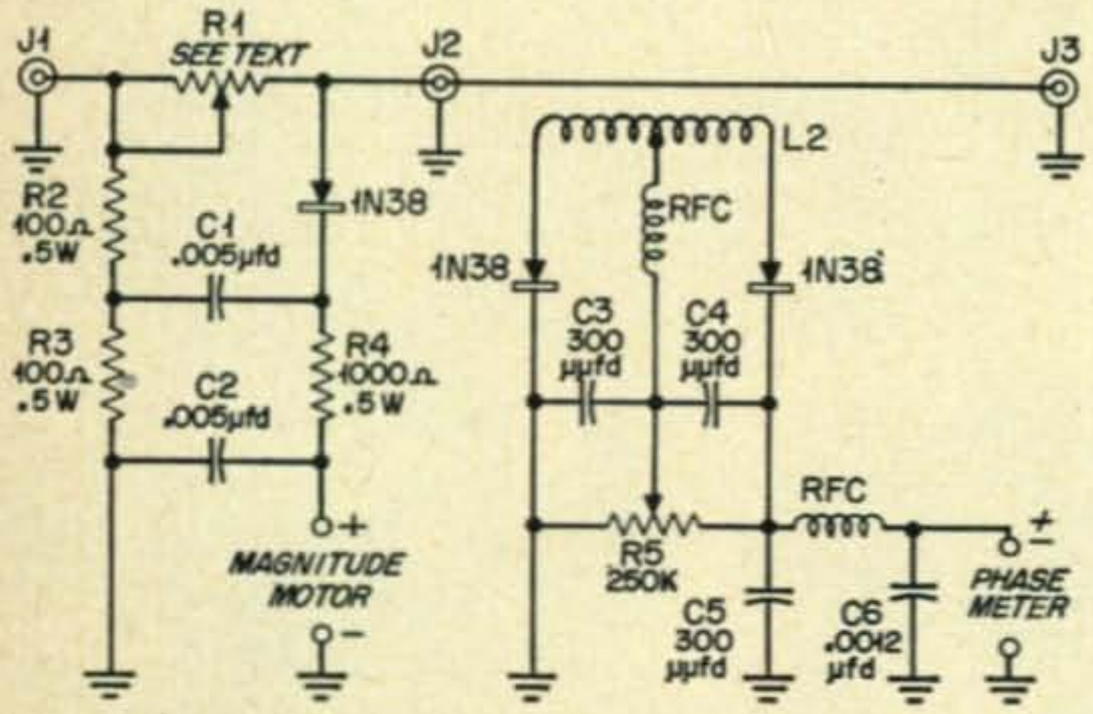
M. K. Brooks & W. Brooks
2461 Neil Way, Hayward, Calif.

Despite the numerous articles that have appeared in *CQ* and various other publications, measuring equipment for determining antenna and transmission line characteristics is conspicuously absent from the majority of amateur shacks. Why this should be so is not very clear. Certainly the apparatus is simpler to construct than, say, a speech amplifier or a VFO.

While making no claims for novel circuitry the r-f unit to be described has proven itself to be useful, accurate and compact. The layout is such that reliable readings may be made through all amateur bands to a top frequency of 250 Mc.

Circuit

The circuit of the Impedance-Magnitude section is that of a conventional type resistance bridge using a carbon potentiometer as the comparison "standard." This resistance and the resistive component of the impedance of the antenna or the transmission line being checked are in series across the "generator" which, in this case, is generally a grid dipper or other r-f source. The r-f voltage appearing at the terminals of the unknown impedance is compared with a fixed fraction of the generator voltage (generally one-half) and the difference between these two voltages is rectified and indicated on a d-c meter.



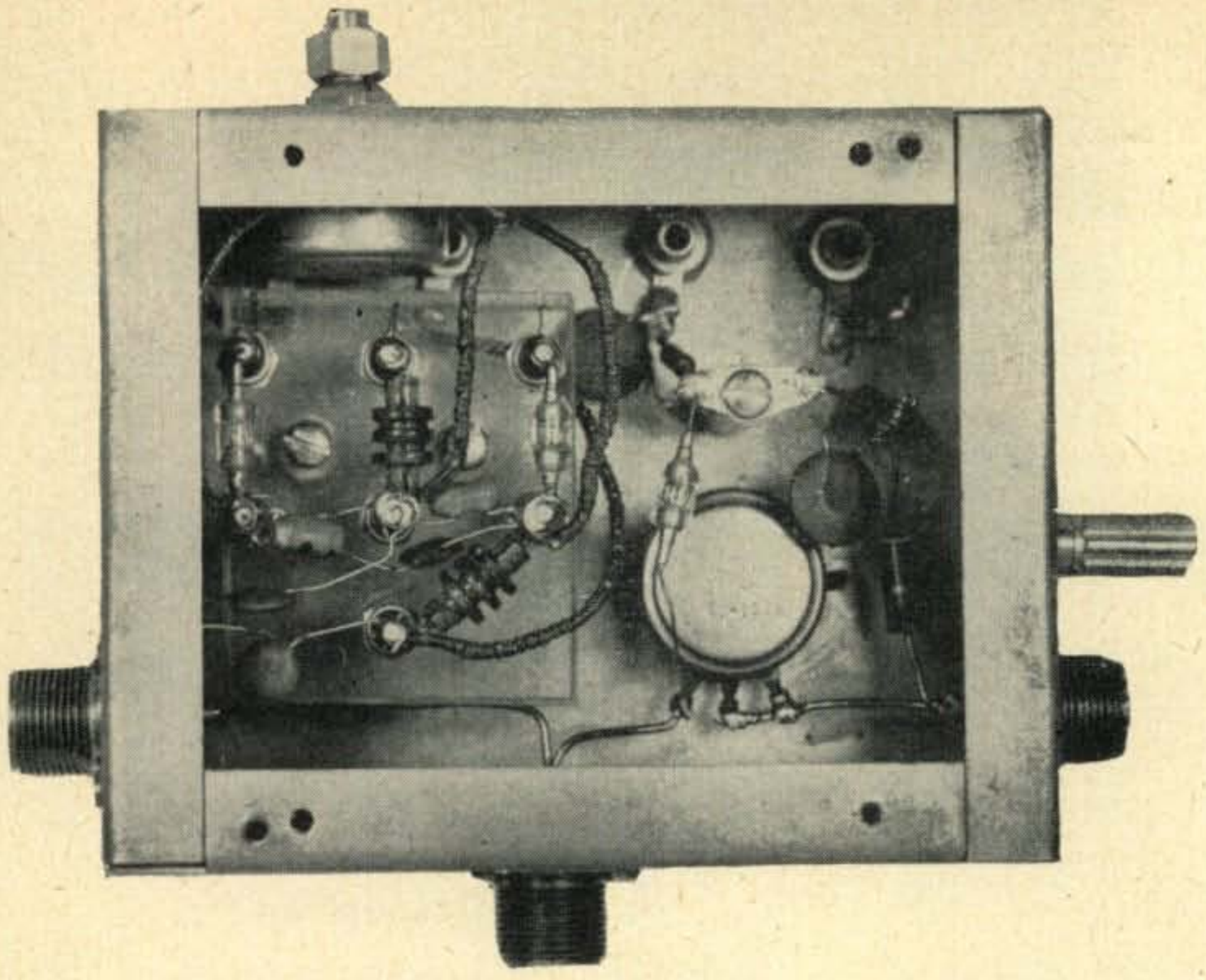
Schematic & Parts List for complete unit

R1 — Ohmite AB linear, see text
R2—100 ohm ½ watt
R3—100 ohm ½ watt
R4—1000 ohm ½ watt
R5—250 K Ohmite AB
C1—.005 disc ceramic
C2—.005 disc ceramic
C3—300 mmfd ceramic
C4—300 mmfd ceramic
C5—300 mmfd ceramic
C6—.0012 disc ceramic
RFC — small RF chokes, not critical
L2—10 turns CT

The indicator of phase relationship is actually a phase discriminator, familiar to all amateurs who have played or worked with frequency modulation systems and a.f.c. circuits. The discriminator is able to function because energy is coupled to its balanced rectifier units through two paths, magnetically in "pushpull" fashion and capacitively in "single-ended" style. Avoiding technically complicated statements we can say that the currents transferred by the magnetic and capacitive modes will only result in equal, balanced output from the two crystal rectifiers when the unknown impedance is nonreactive; that is, when it is a pure resistance. Reactance of either sign (L or C) in the unknown impedance results in an unbalance in the r-f voltages presented to the two diode crystals and a flow of direct current in one direction or the other through the external indicating instrument.

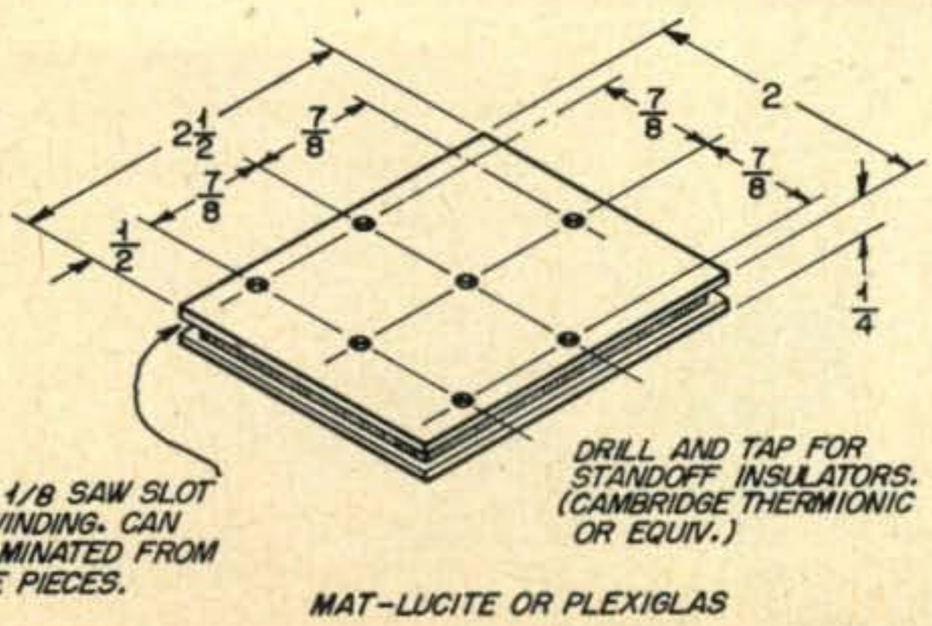
Notes on Layout

No great care need be expended in construction of the r-f portion of the Sensing Unit if it is going to see application only in the lower frequency amateur bands, but a serious attempt should be made to duplicate the physical layout of parts shown in the photograph if operation with reasonable accuracy is expected in the v-h-f range. Stray capacities may be minimized if the "standard" *(R1)* is mounted slightly below the chassis on a scrap of lucite, instead of the grounded method shown. If this is done it will also be necessary to use an insulating extension shaft to *R1*.



Bottom View. Note position of Lucite mounting plate.

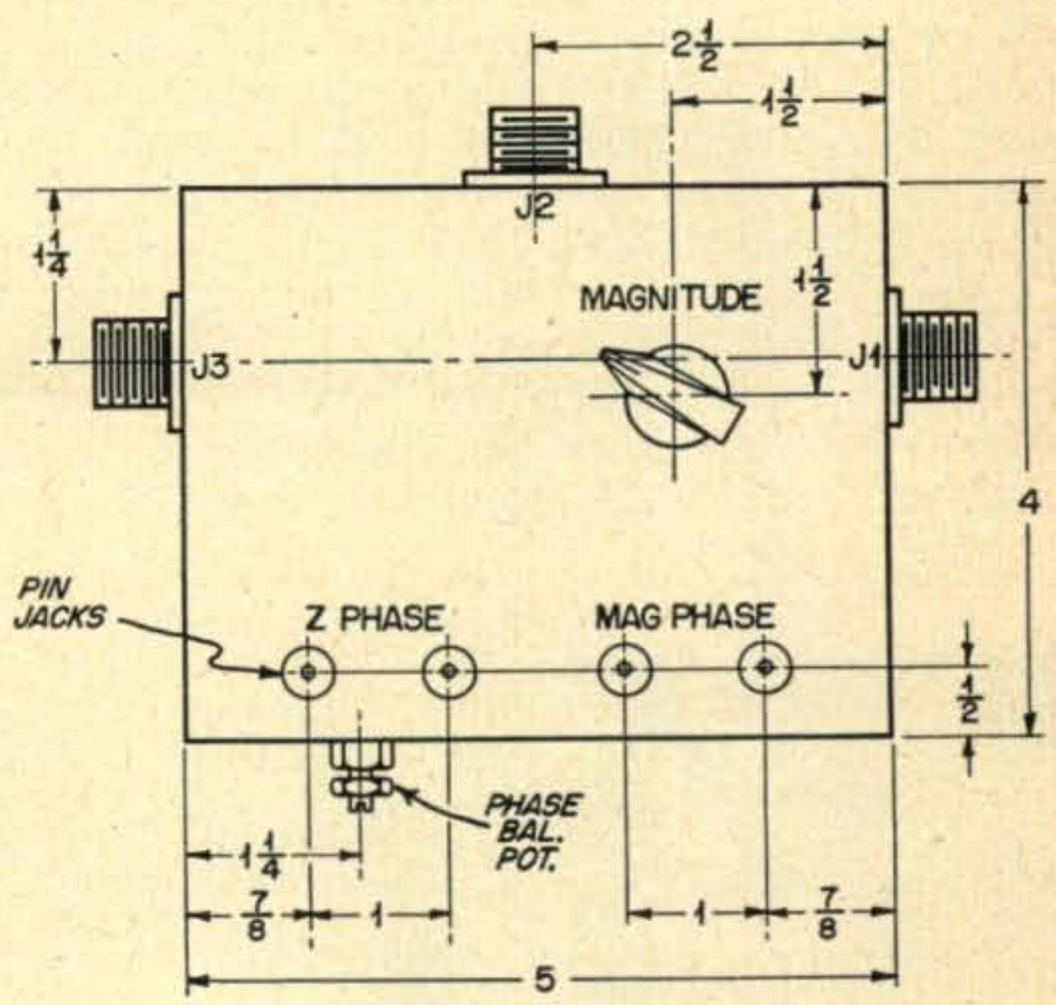
By now you are probably wondering where the capacitive component is brought into the phase discriminator. No condenser is visible but it nevertheless exists. The heavy copper conductor connecting the *J2* and *J3* coaxial receptacles is linked to the secondary coil *L2* by the magnetic lines of force surrounding the conductor and also by the capacitance existing as a consequence of the proximity of the conductor to the coil. Maximum sensitivity occurs when the inductive transfer of energy is equal to that transferred capacitively. Alteration of the spacing between the coil and conductor controls this to some extent. It is particularly important that the coil be mounted symmetrically with respect to the conductor so that equal capacitive coupling exists on both sides of the coil. To facilitate this the coil has a special configuration. It is wound in a groove in the edge of a rectangular lucite sheet which has one edge paralleling the r-f conductor connected to the antenna or feed line. Because of the location of the winding it is not visible in the photo with the exception of the ends of the winding and the tap. The wire diameter is not critical and should be selected for accommodation of the desired 10 turns in the winding space available.



Sub-chassis mounting plate details

Construction

The entire Sensing Unit is contained within a 4 x 5 x 2 inch metal box. The meter-indicators are external to the unit, connected via the tip jacks. This permits remote location of the meters at the transmitter, for example, while the Sensing Unit may be located in the radiating system where measurements are desired.

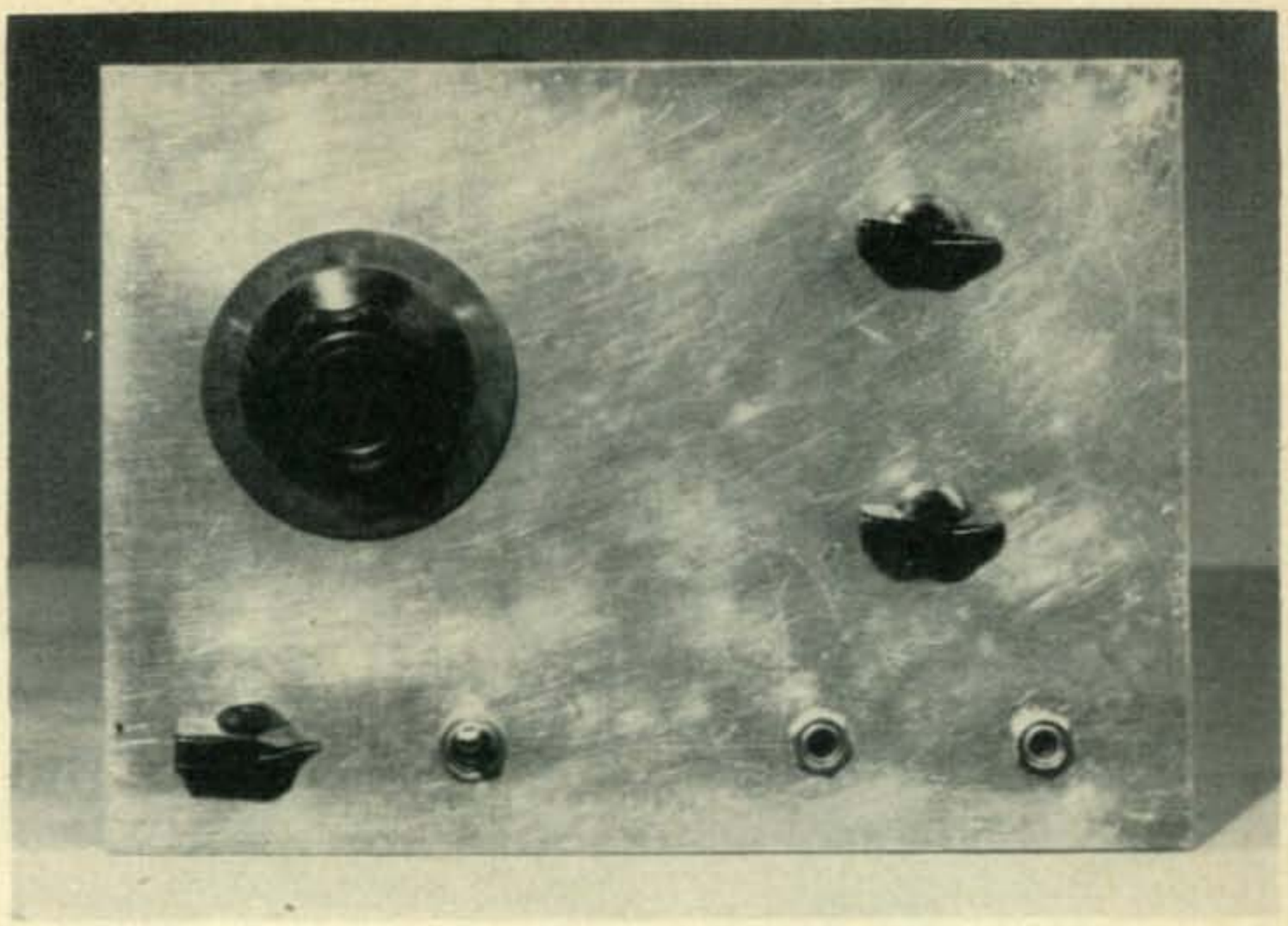


Chassis details

Only high quality carbon or composition potentiometers should be employed. It is important to note that resistors *R2*, *R3* and *R4 must* be a non-inductive type. This excludes common wire-wound resistors. Resistors of these values are quite frequently wire wound. If uncertain, you would do better to sacrifice one resistor by breaking it and performing a "post mortem."

[*Continued on page 120*]

Bob Champlin, K2BKX
131 Bryant Ave., Springfield, N. J.

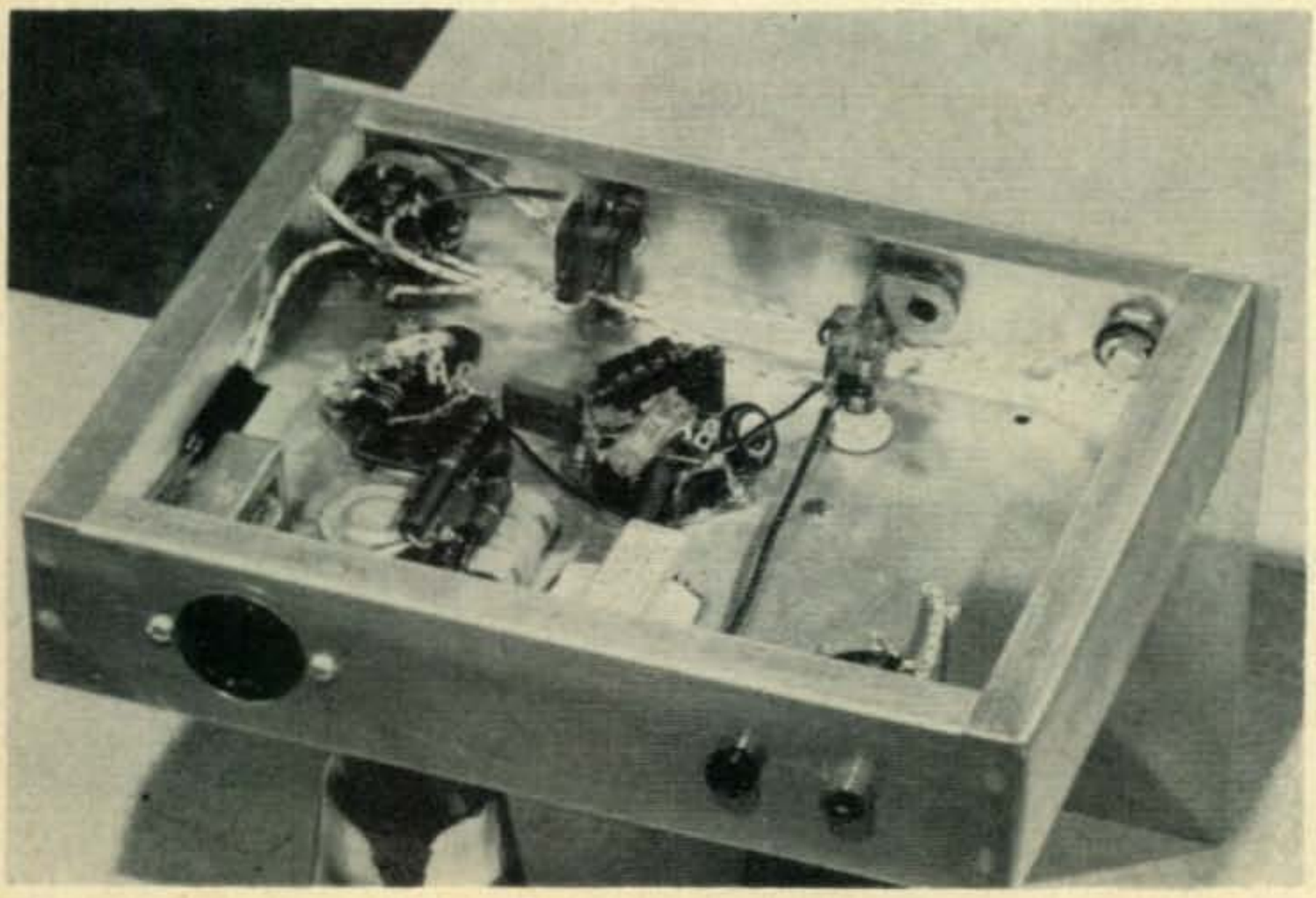


160

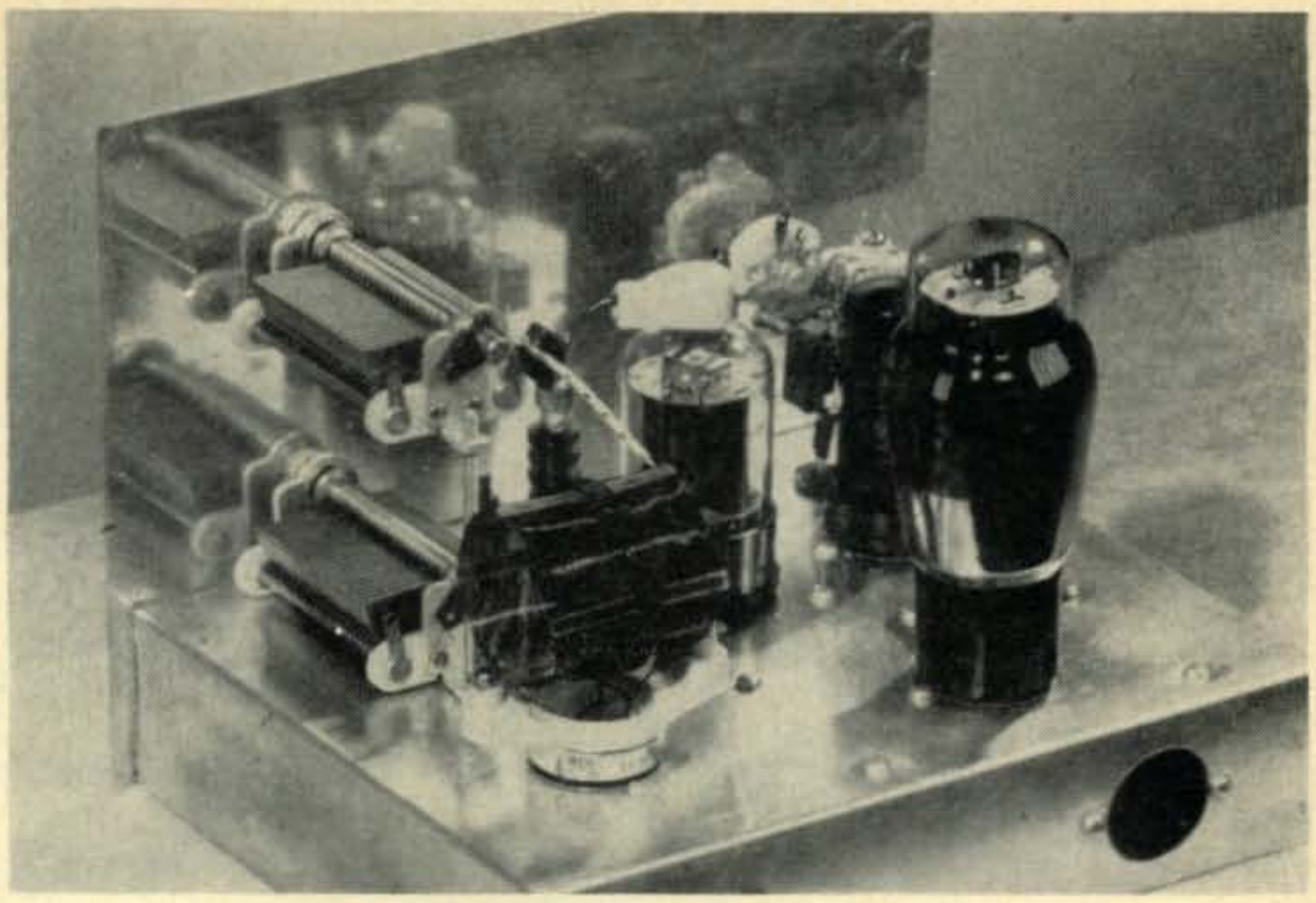
In a sense 160 meters is being as badly neglected as some of the higher frequency bands. Perhaps it is true that 160 meters does not have all the possibilities of the more popular frequencies, but it does offer good communication over a reasonable area, even with low power. On 75-meter phone a low power station has a pretty rough time, but the same 20 or 30 watts on 160 will provide plenty of good contacts. The transmitter required is simple since there are no doubler or tripler stages to worry about. Consider also that at this frequency a stable VFO is just about as easy to build as a crystal oscillator. Even the lack of a proper antenna need not keep you from operating on 160 for the deficiency can be solved with a pi network. Even a 75 meter antenna can do an FB job on 160.

Description

In designing the rig the primary consideration was to have a stable, efficient, and well modulated unit. The oscillator stage uses a 6AG7 since it provides its own shielding and can take a fairly high amount of B+, thereby insuring plenty of drive to the final with little drift. The unique feature of this stage is the v-f-o coil. It is merely an oscillator coil manufactured for a broadcast receiver padded with suitable condensers. The coil normally resonates at approximately 2.5 megacycles, and the use of a 30 $\mu\mu$fd band-set trimmer condenser will bring it down to 1.8 megacycles. Mechanical vibration is eliminated since most commercial coils are quite rigidly constructed and can be mounted firmly. V-f-o tuning is achieved by means of another 25 $\mu\mu$fd variable condenser. At present this condenser is turned by a 3" dial with no reduction mechanism. No trouble is experienced in zero beating a station, however a reduction type mechanism could be substituted. B+ for the oscillator is reduced to a reasonable level by R3.



Bottom view of the simple 160-meter transmitter. Empty space to right can accommodate mike battery.



Rear view showing parts placement. Coils and RFC3 are above chassis.

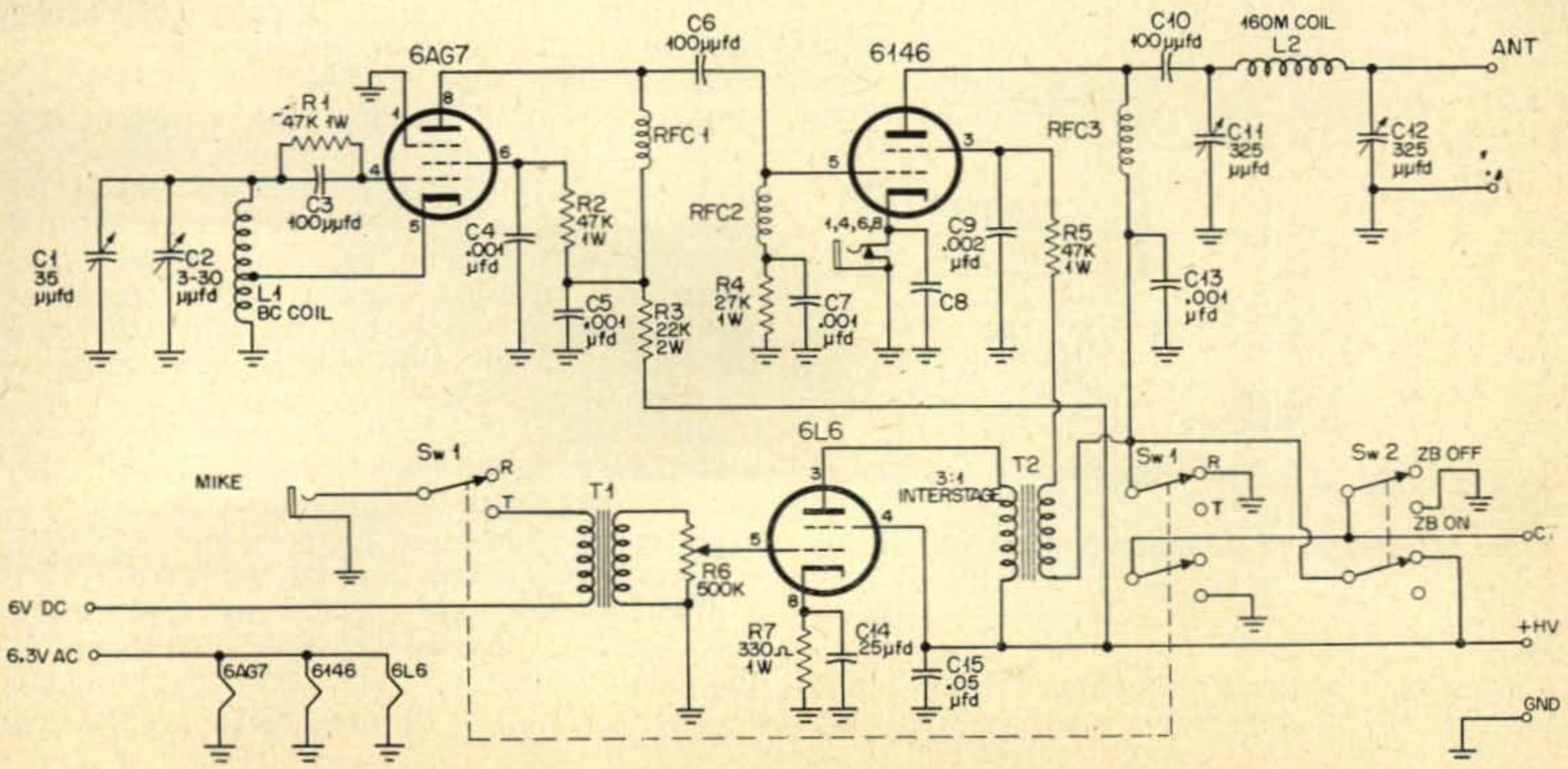
A 100 $\mu\mu$fd condenser couples the oscillator to the 6146 final (a 2E26 can be used). The grid has an r-f choke in series with a condenser and resistor connected to ground. In the cathode there is a closed-circuit jack that allows for metering and keying. A lead running from the plate of the 6146 connects it directly to the plate coupling condenser and r-f choke. The pi-nework consists of a 160 meter coil with tuning and loading condensers. This network will load up almost any length of wire.

A single 6L6 screen-modulates the final. The microphone battery can be placed in the transmitter or in the power supply. It will be noticed that microphone voltage is connected only when S1 is in transmit position. Audio power is coupled to the final screen-grid by means of a small interstage transformer.

Switching from receive to transmit and vice versa is done by a 4P2T rotary switch. The rotary switch, S1, performs the following: a. it connects the microphone voltage on "transmit" position; b. turns on the high voltage by connecting the center tap of the power transformer to ground on the "transmit" position; c. connects the high voltage lead to ground on "receive" position (when S_2 is in the off position) insuring against feedback from transmitter to receiver. S_2 allows the B+ to be applied to the oscillator and modulator only, thus making zero-beating very easy. The voltage is applied

Parts List

R1, R2, R5—47K, 1 watt
R3—22K, 2 watt
R4—27K, 1 watt
R6—500K potentiometer
R7—330 ohms, 1 watt
C1—35 $\mu\mu$fd variable
C2—3-30 $\mu\mu$fd trimmer
C3, C6, C10 — 100 $\mu\mu$fd mica
C4, C5, C7, C13—.001 μfd disc ceramic
C9—.002 μfd ceramic
C11, C12—325 $\mu\mu$fd variable
C14—25 μfd 25v electrolytic
C15—.05 μfd ceramic
L1—BC rcvr osc. coil
L2 — 160-meter plug-in coil
S1—2P4T rotary switch
S2—DPDT toggle switch
T1—Mike transformer
T2—1:3 interstage transformer



to the modulator merely to keep the B+ at a reasonable level.

Construction

The unit is constructed on a 7" x 9" x 2" aluminum chassis. The front panel is also aluminum and measures 9½" x 7". The parts are placed in logical positions for keeping leads as short as possible. The final plate lead is kept very short by having RFC3 mounted above the chassis on a stand off insulator. Also the lead running from C11 to the 160 meter coil is kept short by connecting it directly to the coil.

Adjustment

Once the rig is wired there is very little adjustment required. Oscillator frequency can be checked by listening for carrier on a calibrated receiver. To set the transmitter on 160 meters turn C1 until plates are fully meshed and then set oscillator on 1.8 megacycles by adjusting trimmer condenser. With the rotation of C1 it will now be possible to cover the entire 160 meter band. The final is resonated by C11 and antenna loading is done by C12. With the aid of a pilot bulb in series with the antenna feedline the pi-network is easily adjusted for highest output. R6, the audio gain control, is adjusted for correct modulation percentage.

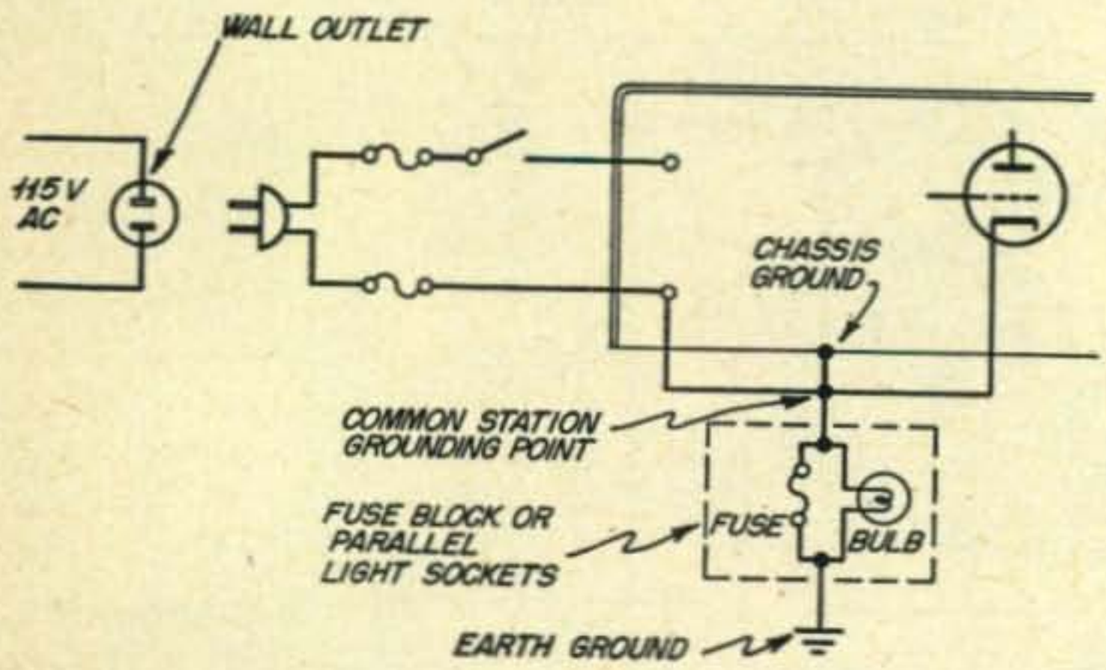
Performance

This rig is the result of many previous experimental transmitters. It works quite well from my second floor shack in New Jersey with a 125 foot long wire antenna cut for 80 meters. Local contacts are easily had and contacts with stations up to 250 miles away are not uncommon. Come on and join us on 160!

Ground For Safety!

All radio equipment must be grounded. That is the first rule of safety. An ungrounded metal cabinet or chassis, or an ungrounded power circuit, can be as dangerous as a poisonous snake. A connection to a water pipe will suffice for the ground connection; but a heavy wire connecting to a pipe driven into the ground is to be preferred, for it offers a more certain connection.

Since one side of the 110-volt lighting circuit is always grounded, it is necessary that the



radio equipment be connected to the power line with the proper polarity, for a reversed connection would put a direct short on the power line.

Most of us depend on a plug in a wall outlet for our power connection. Any time it is removed, whether accidentally or not, the whole process of polarizing it correctly must be gone through again, checking with a lamp or voltmeter before plugging into the outlet again.

A permanent arrangement that facilitates reconnecting the power lead, and also protects the equipment any time the power plug might be removed and replaced incorrectly, is shown in the diagram.

A fuse block of the type designed to hold two screw fuses is installed permanently in the station; and the two fuse sockets are connected in parallel. All ground connections from the radio equipment are bound to a common point and connected to one side of the fuse sockets. The other side of the sockets is connected to the earth ground. Thus the only connection from the common ground point of the equipment to the earth ground is through the fuse sockets.

When the line plug is inserted in the wall outlet, a light bulb is screwed into one of the fuse sockets. If it lights, the polarity is wrong and the a-c plug must be turned over.

If the lamp does not light, which indicates proper polarity of the line plug, a fuse of low amperage rating, say three amperes is screwed into the other socket in parallel with the lamp. This provides a good low-resistance ground connection as long as the line polarity is correct; but if the line plug should be removed and plugged in wrong, the fuse will blow; and then the lighted bulb will give warning of trouble.

Incidentally, the brightness with which the bulb lights when the polarity is wrong indicates the efficiency of the earth connection. If it is a really good connection to moist soil, the bulb will light with almost normal brilliance.

Remember, always unscrew the fuse before replacing the plug in the wall outlet; and if the bulb does not light, screw the fuse in again.

Charles Felstead, KH6CU
2444 Kuhio Ave., Honolulu 15, T.H.

The Harristahl NE-6 Transmitter

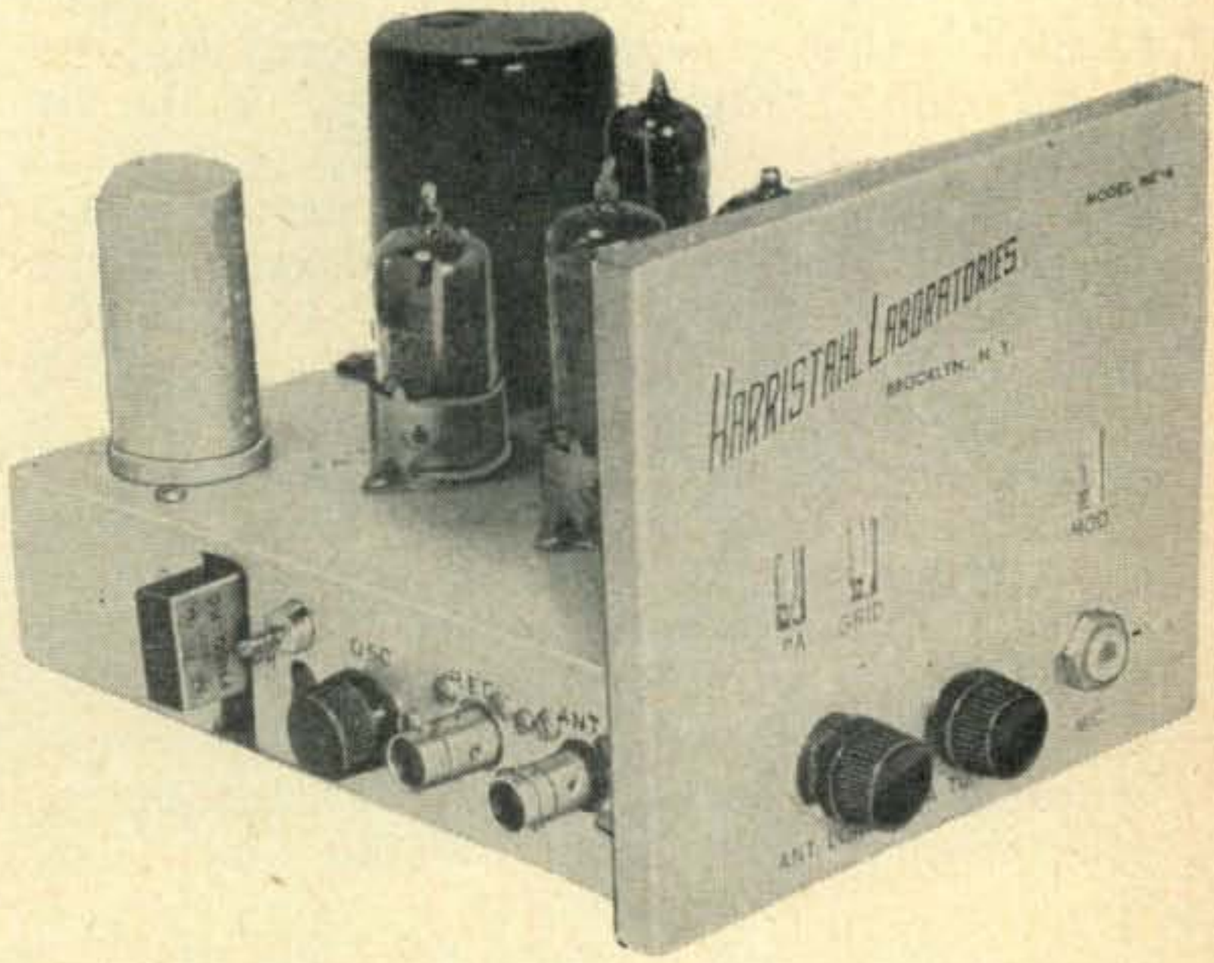
F. S. Harris, W1FZJ
VHF Editor, CQ

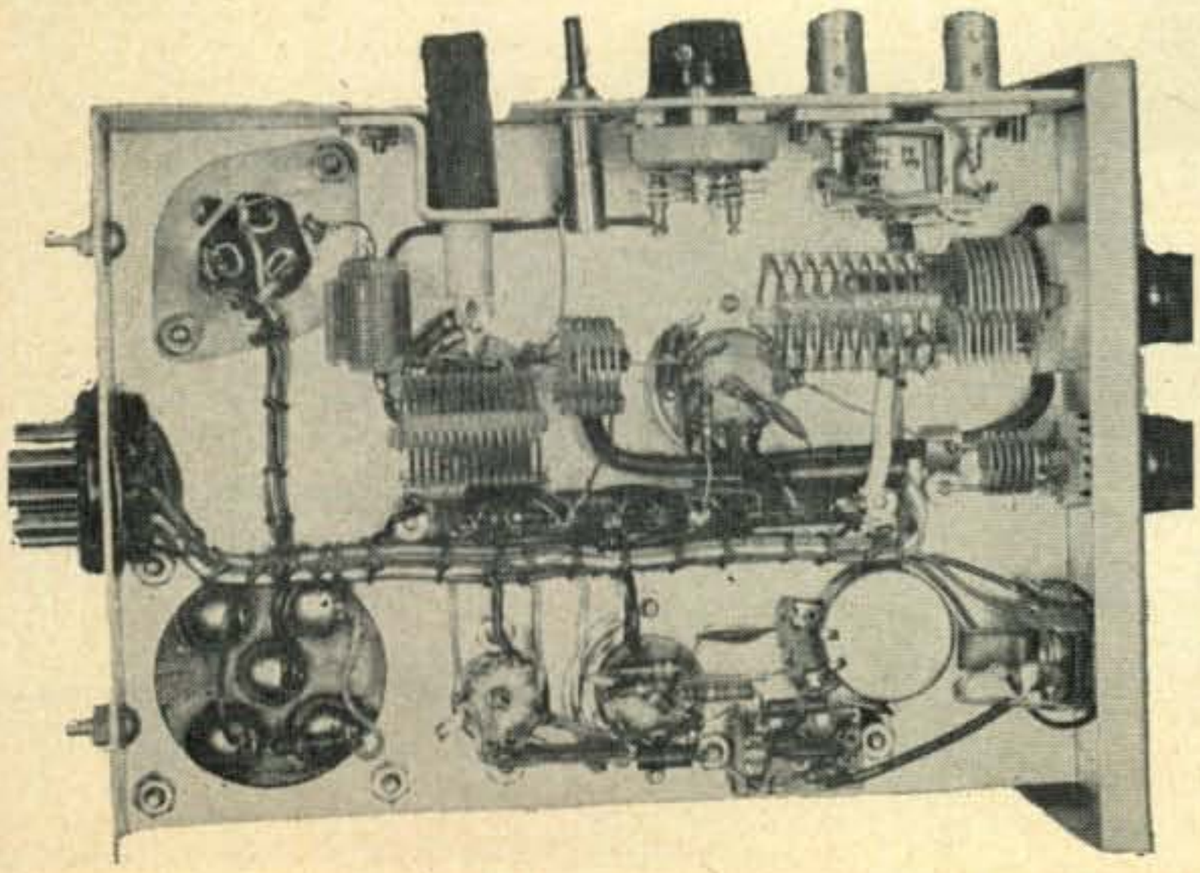
We all laughed when Wayne walked in with the Harristahl Laboratories transmitter. Seems he thought that we should get on Six Meters and talk to some of the boys. Among other things we didn't have any six-meter antenna and the transmitter didn't look big enough to get out of the house, let alone the back yard. Fifty contacts and five states later however we have to admit that looks are deceiving. And *how*! It just doesn't seem possible that such a little package can pack such a wallop.

This little 4½" x 5" x 6½" box of dynamite is completely devoid of any gadgets not necessary to the intended function. Nothing, however, that can possibly contribute has been left out. For instance such desirable features as an antenna relay, push-to-talk and remote control are standard equipment. Tuning is indicated by neon lites giving rise to the oft' heard expression "He's really got his neon's lit tonight". (Oft' heard where?—ed.)

Circuitwise the Harristahl starts with an 8-Mc xtal, a 6U8 oscillator-multiplier and a 5763 r-f amplifier. Only the final tuning and the loading control appear on the front panel. Oscillator and multiplier tuning are available on the side of the cabinet and to date have required only the initial tune-up adjustment. Some oscillator tuning is required when changing from one end of the band to the other but who ever does that?

The audio section starts out with provision for either a carbon or a crystal mike. Plenty of gain available from the cascade 12AT7 speech.





Modulation is accomplished through the good offices of a 6AQ5 and an excellent transformer. Good speech amplifier design plus the built-out modulation transformer resulted in many compliments on the quality (particularly when the XYL, W1HOY, was on the mike).

The amazing results obtained with this transmitter can be in part explained by the good ground-wave conditions extant on the six-meter band. Suffice it to say however, since I started using the KW on Six I have only added three new stations to my list of stations worked. I don't mean to imply that my reports weren't stronger or that my light bill isn't larger. I do say however, for 99% of our contacts on Six this "Neon Special" punch-packed package has all it takes.

DX

Gathered and reported by

R.C. "Dick" Spenceley, KV4AA

Box 403, St. Thomas, Virgin Islands, USA

Our heartiest congratulations go to the following station upon his achievement of WAZ:

No. 314 W7GUV John L. Dack 40-233

we also welcome the following as newcomers to the HONOR ROLL:

K2GFQ 39-172
K2BZT 36-163
W1JDE 36-158

SOUTH SANDWICH ISLANDS, **LU2ZY-LU3ZY:** This expedition, sponsored by the Radio Club of Argentina, appeared on the air December 15th when Jose, LU2ZY, was heard on 14180 phone. Among the first contacts were LU4DMG and CE3JJ. The following night Miguel, LU3ZY, appeared on CW, 14102, 0125 GMT, contacting stations who called some 15 kc below his frequency. All bands will be covered on phone and CW and we understand that activity from these stations will extend through part of January. QSL's should go via the LU bureau. Hope you nabbed them!

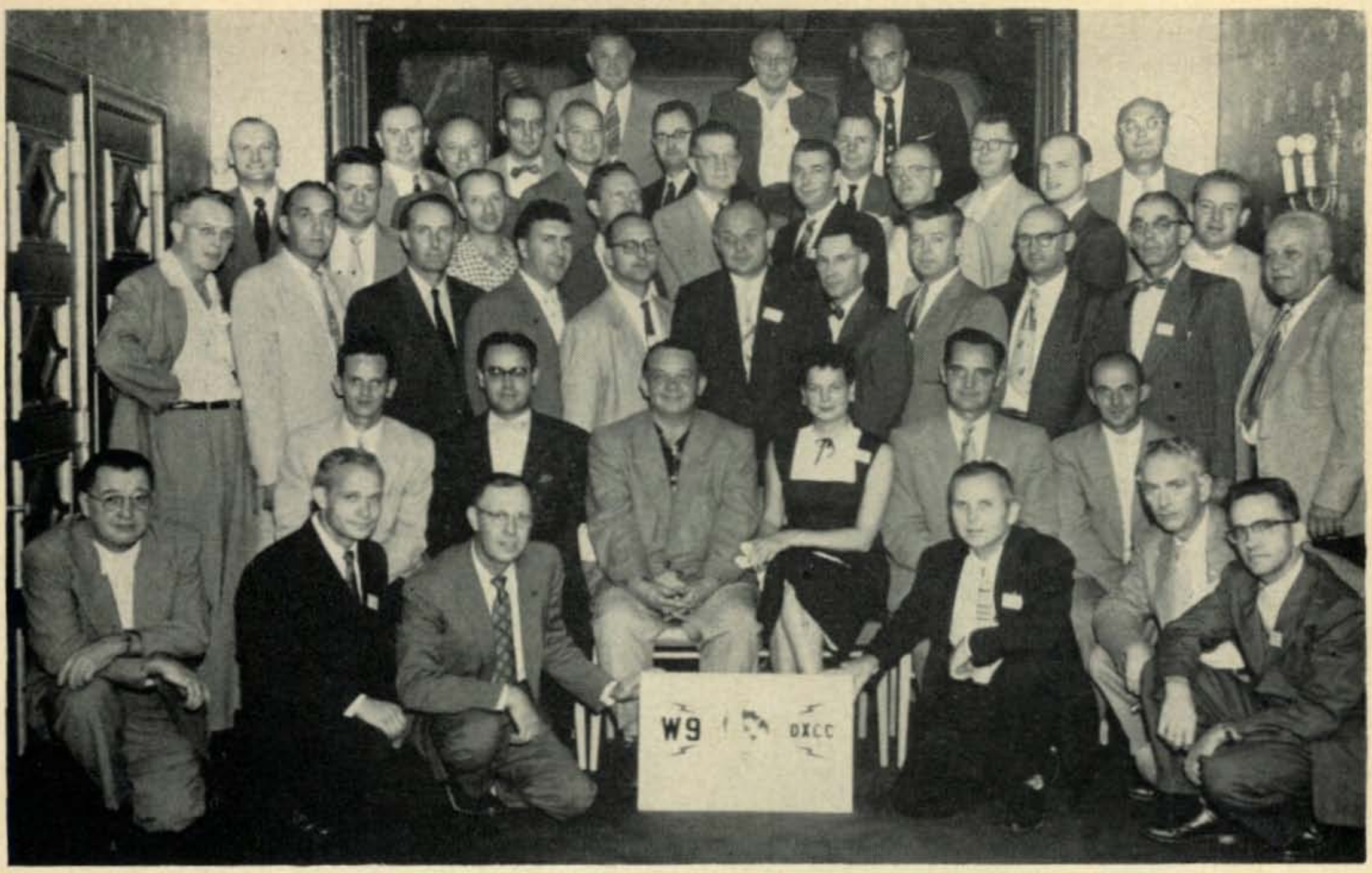
KERMADEC ISLANDS, **ZL1:** ZL2GX is unhappy to report that the projected trip to this spot has been called off due to the impossibility of arranging transportation at this time. Further attempts will be made in May, September and next January. It is possible that a regular operator may turn up at the Kermadecs in the meantime. Former stations at this QTH have been ZL1TZ (now ZL2IC) and ZL1ABZ (now ZL2ABZ).

YASME EXPEDITION, **VP2VB/P:** Danny arrived safely in Papeete, Tahiti, on December 9th thereby completing his longest over-the-water hop in just 60 days time. He has applied for a FO8 ticket which will probably be granted sometime in December. A two months stay may be necessary in Papeete to effect necessary repairs to the YASME and to bypass the typhoon season. (Flash! — Danny appeared on the air with the call "FO8AN" on December 18th.)

SAN MARINO, M1: **M1B** reports (via letter to W4QCW) that he is perfectly legal but says the M1 prefix is pirated by many. Active from this spot are M1B (phone), **M1C** (phone) and **M1H** (CW). All other M1's heard are NG. See QTH's. (The international prefix for San Marino is the block from 9AA to 9AZ)

ADEN, **VS9AS:** This station recently appeared in Aden, for a year's (possibly longer) stay. He is Alan, G3ANK, and runs 15 watts to a 6L6.

Steffen, DJ2LD, of Bochum, Germany



W9-DXCC Dinner. Front row, kneeling: W9's, LI, PCF, FID, NN, DSO, MXX. Second row, seated: JJF, VND, UJ, QLH, GRV, KXK. Third row, standing: AIO, FKC, NDA, GIL, FDX, EWC, QIY, LNM, RBI, HP, UQT. In order, group standing: YFV, HUZ, FJY, AMU, RKP, JIP, ALI, UM, WFS, GDI, UXO, IU, UIG, TKV, DPI, GNU, FNR, JUV, FU, ABA.

Present receiver is an O-V-2 with no band spread but a HRO is on the way to him. He cannot QSL for the OLD VS9AS who, it seems, was a little stingy with the pasteboards. See QTH's.

BRITISH NORTH BORNEO, **ZC5GN:** VS1GN planned to spend his vacation at this spot and should have been heard during the latter part of December. **ZC5CA** is also active from this QTH.

BRUNEI, **VS5EW:** This station was active for two weeks in December from this spot on 14 Mc. CW. QSL's should go via VS1EW.

SEYCHELLES, ZANZIBAR, ALDABRA: We understand that some ZS station plans an expedition to these spots early in 1956.

COMORO ISLANDS, **FB8BR:** This jaunt came to grief when Hubert was refused a license due to not being a resident of the Comoros. Other attempts will be made to obtain this license, with reasonable hopes of success, in the near future.

LEEWARD ISLANDS, **FP8AK/VP2:** Plans at W2BBK call for much airing of this call sign during the first week-end of the ARRL DX contest.

TURKS AND CAICOS, VP5: **VP5DC** continues activity at Grand Turk aided by **VP5GB.** There are two other hams awaiting tickets. VP5BM is now in St. Lucia, Windward Islands, where his call is **VP2LH.**

MONACO, 3A2: The following 3A2 calls have been received by members of the La Rochelle Amateur Club: **3A2BN**-K2JCS/F7ER, **3A2BP**-KØBGZ/F7AM, **3A2BQ**-K6CDT/F7CZ. Visits to Monaco by one or more of these calls may be expected shortly.

GLORIEUSE ISLAND, FB8: Via CN8MM we hear that there will be ham activity from this spot during May.

DX Notes

After a years absence Dwight, VP1AA, is on the air again and may be heard on a dozen or so xtl frequencies. . . . A goodly number of hams ponder the location of **VUØJI** who gives his name as Osm and says QSL via Box 35, New Delhi. . . . VR3A leaves Fanning via SS WAITOMO on Boxing day (?—See Marciano) for Vancouver and will visit stateside hams. We understand that Ray will spend another tour of duty at Fanning after his present six months leave. . . **HS1SS** has been heard on 14170, A3, and **HS1VR** has been active on the CW frequencies. . . . Recent activity of HVØEA, who QSO'd W6ENV, W6MUR, W6AOA, W6BAX, etc., is branded by I1ADW as a phoney. I1ADW tried desperately to obtain permission to operated from HV-land without success and states that there has been NO HV activity to date and holds a pessimistic view of there ever being any. . . . Bob, **4X4CJ,** advises that he is on daily at the following times and frequencies with 25 watts: 3505/3520 0415/0445 GMT, 21010 1600/1655 1800/1855 and 28010

Nico, I1BVP, Citta di Castello, Italy, runs 50 watts to a folded dipole. Receiver is a BC-312. (Photo courtesy W6NIF/4)

1400/1555 GMT. . . . Via W6YY we hear that **ET3AH** operates regularly on 14010 and will listen for phone if requested. **ET3TRC** operates from the Ethiopian Centennial Fair and may be heard on 14,195 phone. Only other ET3 stations are **ET3LF** and **ET3Q. VR6AC** operates on 14,143 for a couple of hours on Tuesday and Saturday nights. Floyd made 77 contacts in October. Dick, **ZD6RD,** is unhappy about some character named "Chuck" who uses his call on CW. ZD6RD is practically always on phone. VK6MK has arrived back home and should provide a "big noise" from Western Australia with his 85 foot stacked Telrex beams on 14, 21 and 28 Mcs. Iris, ZS2AA, advises that there are 83 licensed YL stations in South Africa and you may obtain a sheepskin for working ten of 'em. . . . **VK5TL,** a northern territory catch, is active daily on 14 CW. He is the Postmaster at Alice Springs, N.T. . . . QSL's for Ferte, **FB8ZZ,** should go via R.E.F. His log is transmitted to F9AA each week via FB8BC and CN8MM. . . . **VS1GU** was due to return to G-land. . . . 4S7's: PT, KH, GE, AM, BJ and BW are supplying plenty of CW from Ceylon. All hail from G-land and most will be two more years at this QTH. . . . Word from Larry, VE7QF, submits detailed info re the new VEØ prefixes. VEØN– calls are allocated to amateur stations aboard ships of the Canadian Navy while the block VEØM– is for ships of Canada's Merchant Navy. These calls are similar to club calls and are allocated 'one-per-ship.' These calls were authorized in May '54 but, in 18 months, only two have been on the air. . . . Our mention of the QTH of **HV3UBW** in Dec. CQ brought a speedy reply from Nick Karim, W1UBW/2, who may be reached at 120 Norwood Ave., Long Branch, N. J. Nick advises that he knows who is bootlegging this illegal call but no means of proving it. Nick has operated as W1UBW/V06/W7/W1/W3 but never as HV3UBW. . . W2BLU advises that we were misinformed on the QTH of **5A1TL,** given as Box 61, Maybrook, N. Y. 5A1TL is unknown at this address. Sorry. . . .

L to R are the following DX'ers from Palermo, Sicily: Peter IT1ZWS, Peter IT1ZGY, Frank IT1BXX and Dom, IT1TAI.

Slightly "radio-active" are the Metke family of Roseville, Calif. L to R are Doc, K6HLO, OM Bob, W6SUP, Janet and Jerry, K6GKR. We will bet it won't be long before Janet is trading in that doll for an 807 too!

160 Meters

Quoting W1BB's Bulletin No. 1 here are some top band items. **HB9CM** will be on 1850 and 1770 kcs looking for DX contacts, especially W9, WØ, South America and Oceania. HB9CM promises to give 160 a real going over this season and will be a good contact for many . . . **YI2AM** reports that top band operation is not allowed in Iraq . . . November 6th operation encountered high static and LORAN (1850 kc). **TI2BX** was heard calling W1BB and W1AHX. No other DX was heard and many W's when QRT early due to the QRN . . . **VS6CQ** nabbed **ZL3GQ** on Nov. 5th reports were 449 and 349. Tom, VS6CQ, has now returned to Scotland. Tests conducted between VS6CQ and W8GDQ/W1BB for two months this fall met with no success . . . November 20th saw W3RGQ working **G5CV** through high QRN from snow-storms and high winds. TI2BX was worked by W6PNE, W8ANO and W3FBV. WWV was sending "N4." In G-land however, **LU1EL** was heard on 1800 kc and **G3PU** worked **ZL1GX** (449/559). ZL1GX heard **G6VC.** Other G's on hand were **G5JU, G3ATU,** SWL Norman Hall and **GI3IOS** . . . November 27th was a fairly quiet night. Absence of LORAN on 1850 was very gratifying and QRN level not bad. At 0545 GMT KP4KD appeared and worked W1BB, W3FBV, K2MJZ. No European was heard. Active were W's K2MJZ, W2JHC, W3RGQ, W3FBV, W3WGY, W3SJN, W4SIB, W6SK, W1BB, W1AHX, W1JRU, W8BJM, W8NBD, W9PNE and WØIFH . . . W3RGQ reports that **VP1SD** will be on after Dec. 1st . . . W6SK is a new one from the West Coast . . . W5SOT stands ready to dish out New Mexico contacts for WAS aspirants . . . Jim, **YN1AA,** had no difficulty hooking W2QHH on schedule, 0930 GMT, for solid CW and phone contacts. Jim has a DX-100 rig on 160 and is due to provide many with a new country this season.

DX'ploits

Maestro Charley, W1FH, leads off again with **AC5PN** for a 265 total . . . Marv, W6VFR, adds **YA1AM** and **XW8AB** for 261 and miked with **FB8BC** and **XS2MI** to up his phone total to 188 (Others can catch up to Marv now as he has announced marriage plans which will result in his being off the air for a year or more) . . . Frank, W6SYG, hit 257 with YA1AM while another Frank, W6AOA, rises to 256 with YA1AM . . . Al, W8PQQ, nabbed AC5PN for 255 as Frank, W6MEK, rested on 254 with FW8AB and XW8AB . . . Bill, W6SN, went to 253 with XW8AB and YA1AM while Jock, ZL2GX, hit a modest total of 251 with **ZL1ABZ** (Kermadec Is.), **VS4BA, FW8AB,** XW8AB and YA1AM . . . Glenn, W6ADP, slides to 248 with MP4QAL as Oscar, W3JNN, keyed to 246 with AC5PN, **HS1VR** and YA1AM. W3JNN also raised his phone total to 214 with **ZC5CT** and **MP4JO** . . . Gene, W6EBG, roped XW8AB, **MP4QAL** and **FB8ZZ** for 245 as Vince, W5KC, hit 236 with YA1AM . . . Art, VK2ACX, made it 233 thanks to AC5PN, XW8AB and YA1AM as Horace, W6TI, rose to 231 with XW8AB and FB8ZZ . . . Jack, W6NTR, adds 12 with **I1DCO/M1, OY4XX, PX1EX, VQ8CB,** WF8AB, **HI6EC, 3A2BH, EA6AF, VQ8AG,** YA1AM, MP4QAL and XW8AB, which covers just about everything which has raised its head recently, for a 218 total while Thor, W6LN, goes to 207 with such as **HKØAI, VS5CT,** XW8AB, **ZS8L, YJ1DL, PZ1BS** and **VQ6LQ** . . . Wally, W7ENW, nailed **FP8AP,** 3A2BH, **ZD6BX** and MP4QAL for 193 as Vip, W6ID dropped up to 168 with **9S4AX, SP5AR** and **ZB1AY** . . . Yours truly, KV4AA, added **UH8KAA** and **LU3ZY** (South Sandwich) to reach 250 while Howy, W2QHH, hit 233 with **VL6LQ** and VQ8AG . . . Norm, W1HX, moved to 231 with YA1AM who also made it 231 for Van, W9HUZ . . . Joe, W8UAS, added FB8ZZ for

Querying the FCC as to whether **3W8AA** might be contacted by W stations seeing that this station operates from the communist controlled section of Viet-Nam, W5FXN/K5ABW was informed that the ban still applies and any W working this station would be subject to citation as per FCC notice of September 12th, 1955.

a 224 total while George, W2HZY, added 23, including such as **ZS7H, FD4BD,** XW8AB and **OD5AV,** to reach 223 . . . Ren, W3KDP, nipped **ZS5CT,** MP4QAL/B and YA1AM for 218 as Guy, W6DI, miked with **ZC4RX** for a phone total of 215 (phone/CW 216) . . . Chas., W3DKT, upped to 216, thanks to MP4QAL, as Bill, W8KPL, made it an even 200 with **ZD3A,** XW8AB, ZD6BX, and MP4QAL . . . Pat, W2GVZ, goes to 198 with **VS1DW** while Bob, W1KFV, ups to 194 with **LU4ZG, FB8BU,** FD4BD, HKØAI, ZS7H, **VS2DW, ZS9O,** YA1AM and MP4QAL . . . Willy, OE3WB, submits new list with a 39-193 total while Hal, W6TXL, goes to 185 with 3A2BH, MP4JO and ZS2MI . . . Bob, WØQVZ, hits 180 with **CR5JB** (Sao Tome), MP4QAL and **MP4BBE** as Larry, W9ALI, adds **VK9WP,** XW8AB, VQ8AG, **VR2CZ, KJ6BG,** VP5DC and VQ6LQ to rest on 151 . . . Charlie, W5KUJ, leads the 38 zoners with 200 thanks to such as XW8AB, YA1AM, **3V8AS,** VQ6LQ, **VR6AC** and VS4CT while Rip, W4EPA, ups to 182 with VU2KM and MP4QAL . . . Smitty, W9FNR, rises to 175 with **ZS3HX,** MP4BBE, MP4QAL, HZ1HZ, VS2DW, **KC6CG,** 3A2BH, **XZ2OM,** VP2LH, **FQ8AX, OY7ML** and FD8BD while Jim, W5FXN, finally grabbed XW8AB for No. 190 . . . Wilson, W3WU, snagged LZ1KSP, LU1ZG, LU1ZT, ZD8E and VQ4GC for 173 as John, W9WCE, goes to 166 with 3A2BH, ZC5CT, OY1R and XW8AB . . . Harry, WØANF, keyed with **BV1US, OY2H, VP8BC** and **FK8AO** for 176 while Bob, K2GMO, went to 162 with CR9AI, **ZS9O,** LU4ZG and **UC2KAB** . . . Miles, W6ZZ, sticking to 21 Mcs., where his total is 98, added VP8AQ, VP5AE, VP1GG, **I1BLF/T,** ET2AB, ZB1TD, **YU3KT,** KC6CG, ZD6RM and VS2BD, for 146 while Chas., ZL3CP, went to 128 with LZ1KPZ, VP8BC, XW8AB, YI2AM, **VP9BM** and **3W8AA** . . . Bill, W2HAZ, goes to 116 with HR1JZ as Don, W6AM, hit 192 in the "phone only" column with **LA5QC, LZ1KAB, ZC4IP** and **UL7KAA!!** . . . Skip, KN6JQJ (son of W6AOA), worked WAC on the 21 Mc. novice band . . . Fred, W9DYG, goes to 102 with **ZE1JB** and **ET2AG** . . . Paul, W9KXK hits 149 with XW8AB, **ST2AR** and FB8XX . . . George, W9BEK, with Ranger and 3 element beam, nabbed OH5PE, LA5YE, DL1JV, GM6SR, G3LB and KL7MOC on 21 Mcs. while VK3NC, running 8 watts, has a total of 163! . . . Rarest DX at K6DNH includes OK3MM, KG6ABN, CR7CN, VP4LZ, KX6BU and ZC4IP . . . Lloyd, DL4ZC, covered 14 and 21 Mcs. with the former accounting for YA1AM, FB8ZZ and HK3PC and the latter, PY7LJ, VK4ZB, ZS2CB, KZ5KA and XE1PJ.

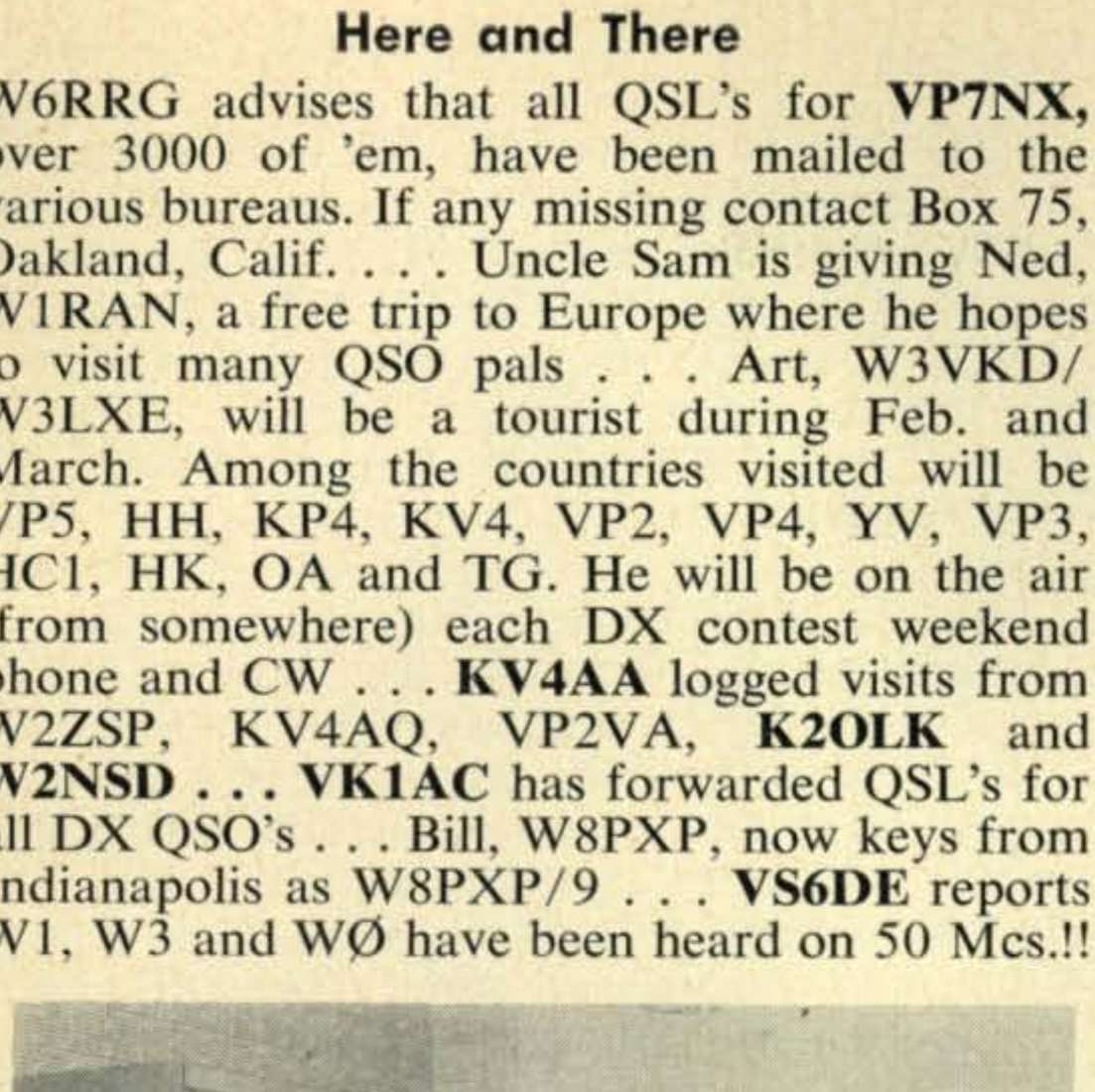
Addresses

CR6DA .....Jesus, Box 1318, Luanda, Angola, Africa.
FB8ZZ .....Ferte, Via R.E.F.
HZ1AB .....(Norm, W4EGG) APO 616, PM., N. Y.
KG6ABN ..... (Bill, W3UIF/KG6) Box 70, Navy 943 FPO, San Francisco, Calif.
KX6BU .....Bob Fernau, Box 3, Navy 824, FPO, San Francisco, Calif.
LU2ZY-LU3ZY ..... (South Sandwich Is.) Via LU Bureau.
LU5VY .....Box 23, Bariloche, Rio Negro, Argentina.
M1H .....Aureliano Casali, Cas. Post. 80, Republic of San Marino.
PZ1BS .....W/VE QSO's via W2HQL. (Others Box 848 Paramaibo.)
SVØWZ .....Bill Needham, USASG, APO 206, PM., N. Y.
UB5KAA, UA6KTB ..... Via DM2ADL, Erich Otto, Box 95, Bautzen, German Dem. Rep.
VK5TL .....Postmaster, Alice Springs, Northern Territory, Australia.
VK9OQ .....(VK2AOQ) D. F. Lloyd, Box 56, Port Moresby, Papua Terr.
VP5GB .....(Turks and Caicos) via WØOUZ.
VP8AL .....(Antarctica) c/o Postmaster, Port Stanley, Falkland Is.
VP8BC .....Box 117, Port Stanley, Falkland Is.
VS1GX-VS1GU ..... Box 176, Singapore, Malaya.
VS5EW .....(Bruni) Via VS1EW.
VS9AS .....Alan Swindon (G3ANK) Box 1245, Aden.
ex-ZC5CT/VS4CT/VS5CT ..... Peter Green, 15 Western Road, Brentwood, Essex, England.

Thanks to....West Gulf Bulletin, K6DNH, DL4ZC, VS1GX, W4QCW and W4CEN.

Here and There

W6RRG advises that all QSL's for **VP7NX,** over 3000 of 'em, have been mailed to the various bureaus. If any missing contact Box 75, Oakland, Calif. . . . Uncle Sam is giving Ned, W1RAN, a free trip to Europe where he hopes to visit many QSO pals . . . Art, W3VKD/W3LXE, will be a tourist during Feb. and March. Among the countries visited will be VP5, HH, KP4, KV4, VP2, VP4, YV, VP3, HC1, HK, OA and TG. He will be on the air (from somewhere) each DX contest weekend phone and CW . . . **KV4AA** logged visits from W2ZSP, KV4AQ, VP2VA, **K2OLK** and **W2NSD . . . VK1AC** has forwarded QSL's for all DX QSO's . . . Bill, W8PXP, now keys from Indianapolis as W8PXP/9 . . . **VS6DE** reports W1, W3 and WØ have been heard on 50 Mcs.!!



Bob McLellan, W6DBP: 39 Zones, 158 Countries.

. . . Our best wishes and WELL DONE! goes to Bill, W2SN, who is "retiring" after a 25 year stint as the W2 QSL Bureau. This considerable chore now passes to W2JIL . . . **CE7BS** is ex-W6DOK and KP4FX . . . Pete, **ZL2SP,** was selected by the Ross Sea Committee to accompany the Antarctic expedition. This will be another ham to look for way down under . . . QSL's for **UC2AA** may go via DL7AA or Box 38, Taganrog, USSR . . . **OHØNB** is the only active ham on the Aaland Islands and is now on 14 Mcs. . . . Tom, W4HYW, reports that Herb, W4NL/HH2OT, will do another tour of duty in Haiti starting this Spring. W4HYW will handle the QSL's . . .

DX Expeditions

We suggest that any hams desiring to participate in any kind of DX-peditions send in their names to KV4AA giving data such as time available, what gear can be furnished, etc. Thus we will be able to bring such hams together for a beneficial pooling of efforts in this direction. Latest correspondent, so minded, is Alex Desmeules, VE2AFC, 186 Aberdeen St., Quebec City, Que. who advises that he would like to join some expedition to the Caribbean area for a week or so this summer. (Mebbe the French would grant a VE2 a ticket to operate St. Martin!!)

DX LIST

Do Not QSO	OK to Patch
EP-EQ	CE
FI8	CM-CO
HL-HM	EL
JY	HC
PK	OA
XU	VE
XV	All W & K
YB-YH	except KA2-KA9
YO-YR	
3W	

Cut this list out and post in shack.

W B C Certificate

SHORT WAVE MAGAZINE takes pleasure in making available a new award, open only to claimants outside of the United Kingdom and Eire, to be known as the "W B C" (Worked British Counties). This Certificate will be granted to overseas stations sending proof of contact with at least 50 different British Counties (i.e. counties within England, Wales, Scotland, Northern Ireland, The four Channel Islands and the Isle of Man). A full list will be published in due course. Stickers will be available for 60, 70, 80 and 90 counties. All bands 3.5 through 28 Mc. may be used. The necessary 50 QSL's should be forwarded to "DX Commentary," Short Wave Magazine, 55 Victoria St., London, S.W.1.

Gil Williams, W1APA, Hazardville, Conn. is seen here at the Mike. His DX total stands at 37-138 phone/CW.

Last Minute Items

From LA9IC we hear that there IS an active ham on Spitzbergen who operates under the call of **LA9TD/P**. His frequency is 3550 kc and he is on around 0700 GMT. Further reports via W3JTC, LA3DB and LA6U advise that he is also on 7 Mcs., 0600/0700 GMT. . . . A very nice morning indeed was December 28th when **AC5PN** knocked off about seven W stations including W3JTC, W3CRA and W4QCW. Time, around 1300 GMT. . . A report from PY2CK advises that **CR8AC**, Goa, was slated to swing into action starting the last part of December. A 100 watt rig will be used and the station will be manned by CR4AL and CR4AK at the Goa Airport. . . . **FO8AN** (VP2VB/P) is heard nightly near 14080 starting about 0200 GMT. Danny will leave for VR1 (Phoenix) early in March. . . The volume of individual ham contributions to the YASME expedition has been disappointingly low totalling, in gear and cash, about $390.00. Contributions from commercial sources have provided over $2000.00 mostly in gear. An idea of expenses may be gleaned when it is known that Danny must take some 250 gallons of gasoline with him on his departure for VR1. This item retails in the vicinity of one dollar per gallon in Papeete. To keep his expedition on the go and to assure Danny plenty of operating time it is requested that one dollar be included for a return QSL via airmail. This does not apply to hams who have already contributed to the YASME cause and will be in effect after Danny leaves FO8AN. . . . New stations in Corsica are Pierre, F9RY, and F9SC. Both in Bastia. . . Steve, K2CJN, will work the first week-end of the ARRL DX contest from **PZ1RM** phone only. . . Cards for **FB8ZZ** should go to F9AA (REF) and, should direct reply be desired, enclose a self-addressed envelope with one IRC coupon. . . Luis, CE3AG, is on again after his European tour while Jim, G6ZO, is back on the job after a substantial South American tour. . . John, **SU1JL**, is active on phone, 14200 xtl, from Ismalia, Egypt. QSL via RSGB. . . W9ZTD and W9OWZ are DX'pedition minded and plan to operate from Cuba's Isle of Pines, CO4/CM4, this Summer. Interested parties might contact them. Other spots might be chosen.

We are sorry to hear that the very fine, and informative, West Gulf DX Bulletin will possibly go out of circulation due to lack of volunteers to shoulder this chore. We are in a position to know the considerable task it is to edit and print this sheet but it is hoped that volunteers within the West Gulf DX Club membership will come forward and maintain this Bulletin on a periodic basis even though the content is much less. . . New in French Equatorial Africa is **FQ8AY** (ex-CN2BD) who may be found around 14080, 1900/2030 GMT. QSL's go via Box 538, Brazzaville. . . FG7XB goes to France this spring and will return with a QRO rig. . . **VS9GV** is active on phone from Aden's Airport (Tks W6YY) also, **YA1AM**, is on at 1300 GMT, Tuesday mornings usually near 14060. . . ex-VP1GG is now in Fiji operating as **VR2BC** on 10 and 15. . . Ken, new op at **ZS2MI** (Marion Island), is on Tuesdays, Wednesdays and Fridays at 1700 GMT. (This is A3 we believe) ZS6FN will continue handling ZS2MI QSL's. . . PY7AN seeks Idaho to complete WAS. . . **VP8BK** is quite active from South Georgia. Eimar is an excellent operator and says QSL via LA1RC/NRRL. Frequency 14014 around 0100 GMT. . . (Via LU5AQ): **LU2ZY** (phone), **LU3ZY** (c.w.) and **LU4ZY** (phone) from South Sandwich were due to leave about January 12th after activity on 14, 21, and 28 Mc. . . **LU7XP**, Jorge, from Tierra Del Fuego was worked on 14080 at 0200 GMT.

Zone Locations and Prefixes for WAZ

ZONE 1—Northwestern Zone of North America. Alaska, KL7, Yukon (part) VE8, Northwest Territories (part) VE8, Dist. of Mackenzie VE8, Dist. of Franklin VE8, Islands West of 102 degrees West, VE8, including Victoria, Banks, Melville and Prince Patrick.

ZONE 2—Northewstern Zone of North America. Labrador VO6, Canada, that portion of Quebec (part of VE2) north of an East to West line drawn along and extended from the southern boundary of Labrador. Canadian Northwest Territories (part of) VE8, Dist. of Keewatin, Dist. of Franklin east of Long. 102 degrees west including the Islands of King William, Prince of Wales, Somerset, Bathurst, Devon, Ellsmere, Baffin and the Melville and Boothia Peninsulas.

ZONE 3—Western Zone of North America. British Columbia VE7, all W7 except the states of Wyoming and Montana, All W6.

ZONE 4—Central Zone of North America. All VE3, VE4, VE5, VE6, W5, W9 and WØ. Wyoming and Montana (W7), Ohio (W8), Tennessee, Alabama and Kentucky (W4).

ZONE 5—Eastern Zone of North America. All VE1, W1, W2, W3, VE2 (South of line mentioned in Zone 2), All W4 except Tennessee, Alabama and Kentucky. All W8 except Ohio, Bermuda VP9, Newfoundland VO1/5, St. Pierre and Miquelon Islands FP8.

ZONE 6—Southern Zone of North America. Mexico XE.

ZONE 7—Zone of Central America. Honduras HR, British Honduras VP1, Guatemala TG, Costa Rica TI, Nicaragua YN, Panama HP, Canal Zone KZ5, Clipperton Island FO8, Cocos Islands TI9, Salvador YS, Swan Island KS4, Corn Island YNØ.

ZONE 8—West Indies Zone. Cuba CM/CO, Puerto Rico KP4, Virgin Islands KV4, Cayman Islands, Jamaica, Turks and Caicos VP5, Bahamas VP7, Barbados VP6, Haiti HH, Dominican Republic HI, Dominica, St. Lucia, St. Kitts, Antigua, St. Martin VP2/PJ2/FG7, Martinique FM7, Guadeloupe FG7, Windward Islands VP2, All Greater and Lesser Antilles except Bermuda and those listed in Zone 9.

ZONE 9—Northern Zone of South America. Colombia HK, Venezuela YV, Suriman PZ, French Guiana FY7, British Guiana VP3, Trinidad VP4, Aruba/Curacao PJ2, Granada VP2, Tobago VP4.

ZONE 10—West Central Zone of South America. Ecuador HC, Peru OA, Bolivia CP, Galapagos Islands HC8.

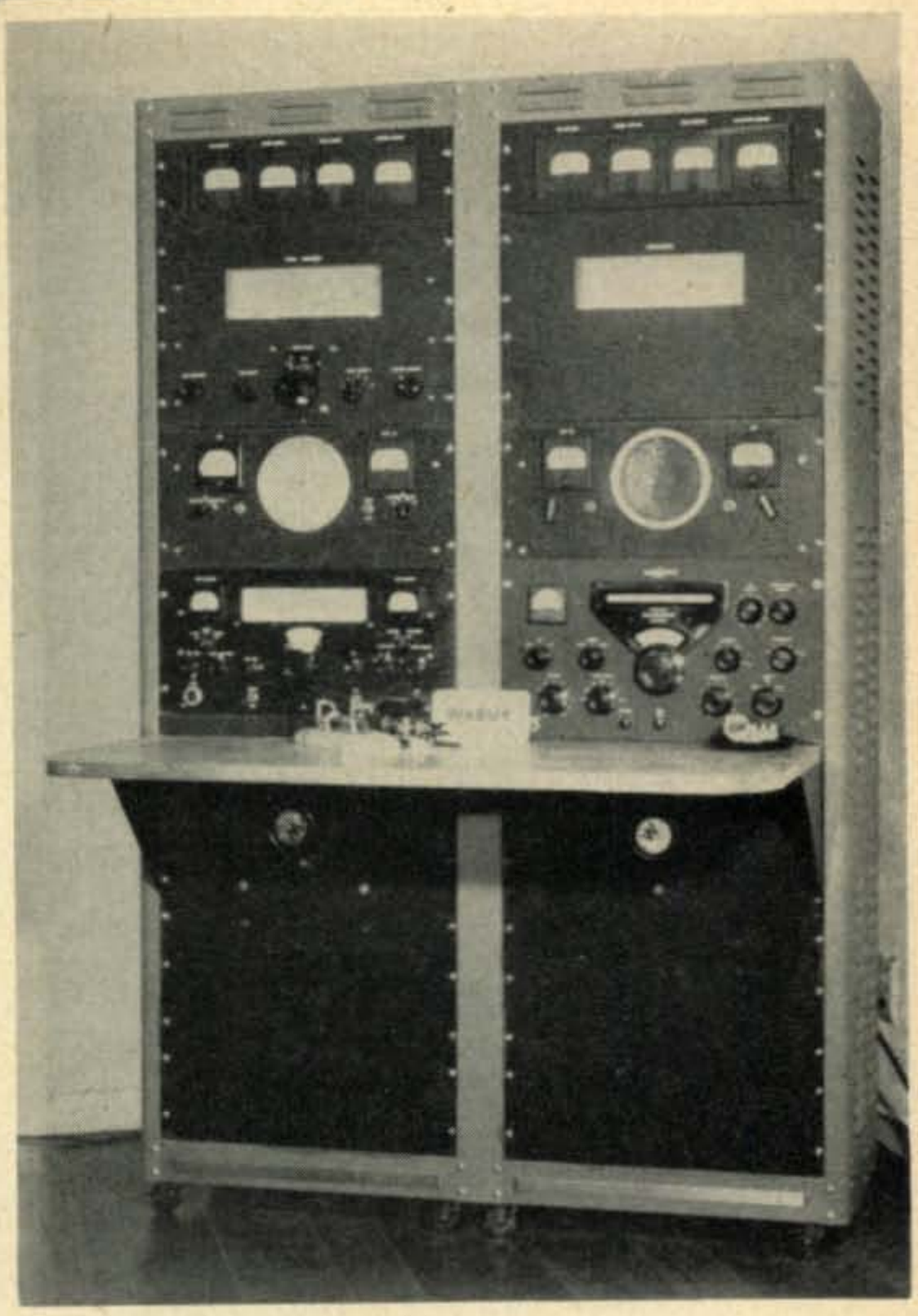
ZONE 11—East Central Zone of South America. Brazil PY, Paraguay ZP.

ZONE 12—Southwestern Zone of South America. Chile CE, Easter Island CEØ.

ZONE 13—Argentina LU, Uruguay CX, All VP8 and KC4 (Little America).

ZONE 14—Portugal CT, Spain EA, Andorra PX, France F, Switzerland HB, Belgium ON, Luxemborg LX, Saar 9S4, Germany (East and West) DL/DJ/DM, Denmark OZ, Sweden SM, Norway LA, England G, North Ireland GI, Scotland GM, Wales GW, Channel Islands GC, Eire EI, Holland PA, Azores CT2, Faroe Is. OY, Gibraltar ZB2, Monaco 3A2, Balearic Is. EA6, Liechtenstein HE.

ZONE 15—Central Europe. Italy I, Albania ZA, Austria OE, Poland SP, Finland OH, Latvia UQ, Lithuania UP, Esthonia UR, Czechoslovakia OK, Yugoslavia YU, Corsica F/FC, Sardinia IS, Hungary HA, Malta ZB1, Sicily IT1, Trieste T/AG/MF, San Marino M1/9A1.



Jack Holmes, W6BUY, started hamming way back in 1922 and is still at it with this pair of 4-250A's and 75A3.

ZONE 16—Eastern Europe. All UA1 except Franz Josef Land and Novaya Zemlya. All UA3, UA4, UA6, UB5, UC2, UN1, UO5. UA9-Baskir and Chkalov only.

ZONE 17—Western Siberian Zone of Asia. UA1-Novaya Zemlya only, UA9-Sverdlovsk, Chelyabinsk, Komi, Kurgan, Molotov, Omsk, Tyumen oblasts. All UH8, UI8, UJ8, UL7 and UM8 (See September CQ 1955).

ZONE 18—Central Siberian Zone. UA9-Novosibirsk, Tomsk, Kemerovo and Altai only. UAØ-Krasnoyarsk, Irkutsk, Chita and Buryat-Mongol.

ZONE 19—Eastern Siberian Zone. UAØ-Khabarovsk, Yakutsk, Primorsky and the northern half of Sakhalin Island. Wrangel Islands.

ZONE 20—Balkan/Asia Minor Zone. Rumania YO, Bulgaria LZ, Greece SV, Crete SV9, Aegean Islands SV, Syria YK, Israel 4X4, Palestine ZC6/8, Jordan JY/ZC1, Cyprus ZC4, Dodecanese Is. SV, Turkey TA.

ZONE 21—Southwestern Zone of Asia. Saudi Arabia HZ, Yemen 4W1, Oman

[*Continued on page 102*]

ALL TIMES IN EST

EASTERN USA TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Western Europe	0800-1330 (2)	0700-0800 (2) 0800-1300 (4) 1300-1500 (2)	0600-1200 (3) 1200-1430 (4) 1430-1700 (2)	1700-2200 (4) 2200-0400 (3) 1830-0300 (3)*
Southern Europe & North Africa	0800-1330 (3)	0700-0800 (3) 0800-1330 (4) 1330-1530 (2)	0600-1200 (3) 1200-1500 (4) 1500-1730 (2)	1700-0000 (4) 0000-0400 (3) 1830-0300 (3)*
Near & Middle East	0800-1100 (2)	0700-1000 (2) 1000-1200 (3)	0600-1100 (1) 1100-1300 (3) 1300-1700 (2)	1730-0100 (3) 1900-0000 (2)*
Central & South Africa	0900-1330 (3)	0700-1200 (1) 1200-1600 (4) 1600-1730 (2)	0600-0800 (2) 0800-1300 (1) 1300-1630 (2) 1630-1930 (3)	1700-2200 (3) 2200-0130 (2) 1730-2230 (2)*
Central & South America	0730-1000 (2) 1000-1600 (4) 1600-1800 (2)	0800-1500 (3) 1500-1700 (4) 1700-1900 (2)	0600-0900 (2) 0900-1500 (1) 1500-2030 (4) 2030-0300 (2)	1800-0400 (4) 0400-0700 (3) 1900-0600 (3)*
South East Asia	NIL	0800-1000 (2)	0900-1100 (1) 1800-2100 (1)	NIL
Australasia	1630-1900 (1)	0900-1100 (1) 1500-1900 (2)	0630-0830 (3) 0830-1900 (1) 1900-2200 (2)	0000-0600 (2) 0600-0830 (3) 0200-0730 (2)*
Guam & Pacific	1600-1800 (1)	1600-1900 (2)	0600-1000 (2) 1600-1800 (1) 1800-2100 (2)	2330-0830 (3) 0100-0700 (2)*
Japan & Far East	NIL	1600-1900 (2)	0630-0900 (1) 1600-2100 (3)	0330-0430 (2) 0430-0630 (1) 0400-0600 (1)*

ALL TIMES IN CST

CENTRAL USA TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Western Europe	0800-1200 (2)	0730-1130 (3) 1130-1330 (2)	0600-0730 (2) 0730-1300 (3) 1300-1530 (2)	1630-2000 (3) 2000-0400 (2) 1730-0300 (2)*
Southern Europe & North Africa	0800-1300 (3)	0630-0730 (2) 0730-1230 (4) 1230-1430 (2)	0530-0700 (3) 0700-1400 (4) 1400-1700 (2)	1630-2000 (4) 2000-0400 (3) 1730-0300 (2)*
Central & South Africa	0800-1400 (3)	0700-1100 (1) 1100-1530 (4) 1530-1700 (2)	0030-0300 (1) 0730-1300 (1) 1300-1600 (2) 1600-1900 (3)	1630-1830 (2) 1830-2200 (3) 2200-0100 (2) 1800-2300 (2)*
Central America & Northern So. America	0800-0930 (2) 0930-1300 (3) 1300-1600 (2)	0700-1100 (4) 1100-1400 (3) 1400-1630 (4) 1630-1800 (2)	0630-1500 (3) 1500-1900 (5) 1900-0400 (2)	1730-0500 (4) 0500-0700 (3) 1830-0430 (3)*
South America	0800-1300 (2) 1300-1600 (3)	0700-1500 (3) 1500-1700 (4) 1700-1830 (2)	0600-0800 (2) 0800-1500 (1) 1500-1930 (4) 1930-0300 (3)	1730-0300 (4) 0300-0530 (3) 1900-0430 (2)*
Japan & Far East	1600-1800 (1)	1600-1930 (2)	0700-0900 (1) 1500-2100 (2)	0200-0700 (3) 0300-0630 (2)*
South East Asia	NIL	0700-0930 (1) 1630-1900 (2)	0700-0930 (1) 1600-2100 (2)	0200-0600 (1)
Hawaii	1100-1300 (3) 1300-1700 (4) 1700-1900 (3)	1100-1700 (4) 1700-2000 (3)	0900-1800 (3) 1800-2000 (4) 2000-2200 (2)	2100-0800 (4) 2200-0600 (4)*

ALL TIMES IN CST

CENTRAL USA TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Australasia	1530-1900 (3)	0900-1200 (2) 1200-2000 (3)	0700-1130 (3) 1130-1400 (1) 1800-2200 (2)	0200-0600 (3) 0300-0530 (2)*

ALL TIMES IN PST

WESTERN USA TO:	10 Meters	15 Meters	20 Meters	40/80 Meters
Europe & North Africa	NIL	0700-1100 (2)	0630-0930 (1) 0930-1230 (2)	1700-0100 (1) 1800-2300 (1)*
Central & South Africa	0800-1500 (3)	0700-1000 (1) 1000-1300 (2) 1300-1500 (3)	0600-0730 (2) 0730-1600 (1) 1600-1900 (3)	1700-2200 (2) 2200-0100 (1) 1800-2200 (1)*
South America	0800-0930 (2) 0930-1330 (3) 1330-1500 (2)	0700-1300 (2) 1300-1630 (4) 1630-1830 (2)	0600-1400 (2) 1400-1800 (4) 1800-0600 (2)	1730-0400 (3) 1830-0300 (2)*
Guam & Mariana Islands	1300-1500 (2) 1500-1900 (3)	1200-1400 (2) 1400-1900 (4) 1900-2000 (2)	1100-1300 (3) 1300-1900 (2) 1900-2100 (3) 2100-2300 (2)	2300-0200 (2) 0200-0900 (3) 0000-0730 (2)*
Australasia	1300-1430 (2) 1430-1730 (4) 1730-1900 (2)	1000-1400 (3) 1400-1800 (2) 1800-2000 (3)	0700-1030 (3) 1030-1200 (2) 2000-2200 (2)	0100-0800 (3) 0200-0630 (2)*
Japan, Okinawa & Far East	1500-1900 (2)	1300-1500 (3) 1500-1800 (4) 1800-2000 (2)	1200-1700 (3) 1700-1930 (4) 1930-2230 (2)	2200-0830 (4) 2330-0730 (3)*
Philippine Islands & East Indies	1400-1800 (2)	0900-1100 (2) 1500-1930 (3)	0900-1200 (3) 1200-2000 (2) 2000-0000 (3)	0400-0600 (2) 0200-0600 (1)*
Malaya & South East Asia	1530-1900 (1)	1500-1800 (3) 1800-2000 (2) 0900-1100 (2)	0900-1200 (3) 1900-2200 (1)	0200-0800 (2) 0400-0600 (1)*
Hong Kong, Macao & Formosa	1500-1800 (2)	1400-1900 (3)	1400-1600 (3) 1600-2000 (2) 2000-2200 (3)	0000-0200 (2) 0200-0800 (3) 0200-0600 (2)*
Greenland	1200-1500 (1)	1000-1500 (3) 1500-1700 (2)	0900-1400 (3) 1400-1700 (4) 1700-1900 (3)	1630-0700 (3) 1730-0600 (2)*

Symbols For Number Of Days Circuit Predicted To Open:

(1) 1-4 days (2) 5-11 days (3) 12-18 days (4) 19-26 days (5) over 26 days.

* Indicates time of possible 80-Meter openings.

The CQ Propagation Charts are based upon a CW radiated power of 150 watts and are centered on Washington, D. C., St. Louis, Mo., and Sacramento, California. These forecasts are calculated from basic ionospheric data published by the CRPL of the National Bureau of Standards and are valid through March 15, 1956.

PROPAGATION

Forecasts By:

George Jacobs, W3ASK/W2PAJ

607 Beacon Road, Silver Spring, Maryland

General Propagation Conditions, February:

The sunspot numbers continue to rise at an unprecedented rate. The Swiss Federal Solar Observatory has announced that the Zurich sunspot number for November, 1955 was 90.2. This results in a provisonal 12-month smoothed sunspot number of 32.7 centered on May, 1955. This month's forecast is based upon a predicted smoothed sunspot number of 56 centered on February, 1956. This is the highest solar activity expected since early 1952.

The Swiss Federal Solar Observatory also announced the important news that this present sunspot cycle (which began during April, 1954) will be one of outstanding intensity, with a maximum likely to surpass all others hitherto-observed. Because of the direct correlation between sunspot activity and shortwave radio propagation conditions, radio conditions during the next few years may be *better than they have ever been in the history of radio! ! !* Next month, an entire feature article, "The Sunspot Story: Cycle 19," will discuss the trend of the present cycle, and the propagation outlook on the Amateur high frequency bands for the next few years. Don't miss it.

During February, the sun continues its travel toward northern skies, and as it does so its distance from the earth is also increasing. As a result, the peak intensity of ultra-violet radiation sweeping across the ionosphere from the sun decreases somewhat from mid-winter values and daytime maximum usable frequencies are expected to be somewhat lower than during the winter months. This is compensated for by the fact that during the longer hours of daylight the ionosphere will be illuminated by the sun for a longer period of time and late afternoon and evening MUF's will be somewhat higher than during the winter months.

The following is an overall picture of band conditions forecast for February and a discussion of qualitative changes in each amateur band from month to month.

For specific times of band openings for a particular circuit, refer to the *CQ Propagation Charts* on the opposite page.

6 Meters: Sporadic-E propagation begins to increase during February. An occasional short-skip type opening, for distances up to about 1300 miles, may occur during the month when sporadic-E conditions exist.

10 Meters: The unprecedented rise in sunspot activity has resulted in exceptionally improved propagation conditions on this band during the winter months. The seasonal reduction in daytime values of MUF will result in the band opening less often during February but world-wide daytime DX is expected during several days of the month. Regular F-layer short-skip openings for distances up to 2500 miles, and occasional sporadic-E short-skip openings up to 1300 miles will also be possible on many days.

15 Meters: Daytime propagation conditions remain excellent for this band and good DX, with relatively low power, should be possible to most areas of the world almost every day. Regular layer short-skip propagation is expected on most days between distances of 750 and 2400 miles.

20 Meters: Good worldwide DX is forecast from shortly after sunrise until after sunset. With more hours of daylight, the band will remain open for longer periods of time than during the winter months. Regular-layer propagation between distances of 350 to 2400 miles will also be possible during the daylight hours.

Based upon the 27-day recurrence tendency a period of exceptionally good shortwave propagation conditions is forecast for February 4-11. A moderate ionospheric disturbance is expected to occur during the period February 13-16.

40 Meters: Fair to good world-wide DX conditions continue during the late afternoon and evening hours. Atmospheric noise levels remain relatively low and signals will be strong on many paths. Early morning conditions to Australasia improving with signals becoming stronger during late February and early March. Regular-layer short-skip propagation possible almost around the clock.

80 Meters: Generally fair DX conditions to many areas of the world from shortly after sunset to shortly before sunrise. Atmospheric noise levels and ionospheric absorption increasing as the spring and summer months approach. Short-skip propagation from regular layers possible around the clock, being limited to distances of about 300 miles during the daylight hours and up to 2400 miles during the hours of darkness.

160 Meters: On evenings when static levels are low, fair DX should be possible to many areas of the world from a few hours after sunset to shortly before sunrise. Because of seasonally high static levels and intense ionospheric absorption, propagation conditions on this band deteriorate as the summer months approach.

Review of Shortwave Propagation Fundamentals (Con't)

Forecast of Ionospheric Disturbances

In previous discussions in this series we have reviewed ionospheric disturbances. Sudden ionospheric disturbances, or SID's, occur suddenly and are almost always associated with visual flares on the face of the sun. They last for short periods of time, upwards to two hours or so, and affect only those transmissions passing through the daylight areas of the world. The ionospheric storm, another type of radio disturbance, develops over a period of a day or two, and generally continues for several days. The ionospheric storm, because of its duration, constitutes the major form of disturbance to shortwave communication. During such periods shortwave signals on frequencies normally well received drop to low values because of increased absorption, and may often disappear entirely. There is a considerable increase in the amount of fading, with the introduction of a type of flutter fade. The higher frequencies are most affected, and there is no discrimination between the sunlit and dark parts of the world. Transmissions in low latitudes, especially near the equator, are less affected than those passing through high latitudes and the paths most severely disturbed are those which pass through certain areas (Auroral Zones) centered on the magnetic poles of the earth. The ionospheric storm begins with a positive phase lasting for a day or two during which time conditions may actually improve. This is followed by a negative phase beginning with a severe decrease in radio conditions. The negative phase may last several days, followed by a slow recovery period. Since these storms can seriously disrupt shortwave radio communications for several days, it is important to give communication organizations and other operating services (commercial communication companies, airlines, operators of navigational devices, amateurs, etc.) using ionosphere-propagated waves the earliest possible warning of the onset of such ionospheric disturbances. Given a forewarning, certain steps can be taken to minimize the effects of the radio storm. High priority traffic can be rushed through before the circuit deteriorates; operations requiring assured communications (such as long distance air flights) can be postponed; and rerouting facilities can be alerted for use until the storm has subsided. During the ionospheric storm, communications in some instances may be maintained on a lower frequency than ordinarily employed; if it is a severe storm, North Atlantic and North Pacific circuits may "blackout" completely. Relaying from station to station over paths less severely affected is then the only way shortwave radio traffic can be moved. Let us suppose, for example, that a severe ionospheric storm is forecast and the direct circuit from NYC to Stockholm, Sweden, is expected to blackout since this circuit passes through the northern Auroral Zone and is therefore most sensitive to radio disturbances. An alternate circuit may be established by transmitting along more southernly circuits less susceptible to the storm. An example of such a path would be the circuit from NYC to Tangier, North Africa. The circuit from NYC to Tangier and the circuit from Tangier to Stockholm both clear the Auroral Zone by a considerable distance and should remain relatively normal. Traffic can therefore be relayed from NYC to Stockholm via a relay station at Tangier. All major communication organizations maintain alternate circuits of this type for use during ionospheric storms. Two large American commercial communication companies and the U.S. Government actually maintain relay stations at Tangier for this purpose.

As far as amateurs are concerned, a forewarning of a storm would indicate that the sun is responsible for poor conditions and that nothing disastrous has happened to the receiving or transmitting equipment. Many an amateur, in the early days of radio, tore equipment apart looking for a defective circuit to explain the lack of reception on the shortwave bands when all along it was an ionospheric disturbance responsible for the blackout. A storm warning can also be an alert for the positive period of considerably improved conditions that precede many storms by a day or so. It can also mean planning to spend a night at the movies rather than at a "dead" receiver.

Short-Term Forecast

In order to accurately forecast an ionospheric disturbance, it is necessary to be able to identify them in their early stages. Lack of knowledge concerning exact causes of these disturbances,

and the fact that they do not all follow similar patterns, makes identifying them in the early stages quite difficult at times. Methods and techniques for forecasting ionospheric disturbances, with as much forewarning as possible, have been in the development stage for the last ten years or so. At the present state of the art, short-term forecasts (up to a few days in advance) are moderately successful and longer-term forecasts (up to a month or so in advance) are considerably less reliable. Short-term indications of the development of an ionospheric storm are now obtained by the observation of active sunspot groups or solar flares occurring near the critical center of the sun's disc. When such an outburst occurs, there is a reasonably good possibility that a storm will begin within 17 to 36 hours. Short-term indications are also obtained by observing fluctuations in the field strength of distant radio signals that pass through or near the earth's magnetic poles. Since ionospheric storms begin in this area, circuits passing through the area will be the first ones affected. Careful observation of the characteristics of the ionosphere and other types of geomagnetic data also permits a fairly accurate short-term forecast to be made. The Central Radio Propagation Laboratory of the National Bureau Of Standards maintains the largest Radio Disturbance Warning Service in the United States. Their forecasts are based on comprehensive observations of solar, radio, ionospheric and geomagnetic phenomena made at recording stations throughout the world. For example, through a program for systematic observation of the sun, coordinated by the Bureau Of Standards, reports of solar activity arrive daily from at least nine observatories in the United States and Europe. Each active region on the face of the sun is judged and evaluated during the seven-day period from the time it appears at the edge of the sun until the time, as it rotates, that it approaches the critical center of the sun's disc. With this wealth of information available to them, Forecasters of the Bureau's warning service continually assess current radio propagation conditions and predict their probable trend. The Bureau's forecasts are available, without charge, to any bona-fide user of the ionosphere. The short-term forecasts for North Atlantic circuits are made up from one to seven days in advance and are revised and reissued each Monday and Thursday. The forecasts are issued in the *Bureau Of Standards CRPL-J* publication. A subscription to this service may be obtained upon request from:

North Atlantic Radio Warning Service
National Bureau Of Standards
Box 178, Fort Belvoir, Va.

Similar forecasts for North Pacific circuits are prepared each Tuesday and Friday and appear in the Bureau's *CRPL-Jp* publication. These forecasts may be obtained upon request from:

North Pacific Radio Warning Service
National Bureau Of Standards
Box 1119, Anchorage, Alaska

A description of up-to-the-minute propagation conditions as well as a short-term forecast announced *a few hours* in advance are broadcast over Nationl Bureau Of Standards radio stations WWV, Beltsville, Maryland and WWVH, Maui, Hawaii. The forecasts consist of (1) Description of propagation conditions at time of issue, transmitting the letter "N" for normal conditions, "U" for unsettled or "W" for disturbed conditions; and (2) Forecast of the average quality of ionospheric conditions for the next twelve hours in accordance with the following scale of rating:

1—Useless	4—Poor to Fair	7—Good
2—Very Poor	5—Fair	8—Very Good
3—Poor	6—Fair to Good	9—Excellent

"Normal conditions" corresponds to Q 6 to 9, Q 5 indicates unsettled conditions and a disturbance is indicated by Q 1 to 4. A typical forecast statement is "N 4", which means that conditions are *now* normal but are *expected* to become poor to fair in the next 12 hours.

The WWV forecasts are broadcast on 2.5, 5, 10, 15, 20 and 25 Mc in *International Morse Code* at 19½ and 49½ minutes past each hour throughout the day. Revised forecasts are issued four times daily at 1:19½ a.m., 7:19½ a.m., 12:19½ p.m. and 6:19½ p.m. EST. Each forecast is broadcast unchanged until the next one is made.

WWVH forecasts are broadcast on 5, 10 and 15 Mc in *International Morse Code* at 9 and 39 minutes past the hour after the time announcement and station identification. Revised forecasts are transmitted at 6:39 p.m. and 10:39 a.m. PST. The 11:09 a.m. transmission is skipped (the station is off the air), but the forecasts are broadcast again at 11:39 a.m. PST and every half hour throughout the day.

Information on current radio propagation conditions and general information on ionospheric disturbances and forecasts may also be obtained by telephone 24 hours a day by calling SOuth 5-6411 (Washington, D.C.) for the North Atlantic Warning Service and Elmendorf 3-2211 (Anchorage, Alaska) for the North Pacific Warning Service.

Long-Term Forecast

The sun makes one complete rotation about its axis in a fraction over 27 days. There is a good possibility that an active sunspot group causing a disturbance will come around 27 days later and again be in a position on the face of the sun to cause another radio storm. Long-term indications that a storm is likely to occur

The Sunspot Story: Cycle 19

The Swiss Federal Solar Observatory has recently announced that the new sunspot cycle, which began during April 1954, will be one of outstanding intensity, with a maximum likely to surpass all others hitherto observed. Because of the direct correlation between sunspot activity and ionospheric conditions, short-wave radio conditions during the next few years may be *better than they have ever been in the history of radio* . . . with the possibility of world-wide DX in Six Meters, around the clock DX on Twenty Meters, direct reception of European and Latin-American TV transmissions and other transmission conditions that occur at best only once in a decade and possibly only once in a lifetime!!

Because of the tremendous impact that this may have upon amateur radio, *CQ's* Propagation Editor George Jacobs, W3ASK, has analyzed the situation and will discuss the propagation outlook on each of the high frequency Amateur bands for the next few years. Don't miss it in the March issue of *CQ*.

[*from preceding page*]

may be given by this 27-day recurrence tendency of the sun. A series of 27-day recurrences does not however continue indefinitely, and quite often active areas develop when 27 days prior to their development solar conditions were normal. For these reasons the 27-day recurrence tendency of ionospheric disturbances can only be used as a guide rather than as an accurate forecasting technique. The National Bureau Of Standards includes long-term forecasts (made 25 days in advance) in the *CRPL J* and *Jp* series.

The ionospheric warnings appearing in this column every month are based upon the 27-day recurrence tendency of ionospheric conditions.

Evidence that a direct relationship may exist between radio storms and the position of certain planets with respect to each other and the sun has been disclosed by John H. Nelson, radio propagation analyst of RCA Communications, Inc.[1] Mr. Nelson suggests that these storms may be forecast *months or even years* ahead of their materialization, thus permitting ample time to select the best radio channels to avoid traffic curtailment. The general opinion today, concerning Mr. Nelson's theory is that a great deal of research is yet needed on the hypothesis of a planet-position effect on the ionosphere before it can be accepted as an accurate method for long-term forecasts of ionospheric disturbances, but it may be a step in the right direction.

1 "Effects Of Planetary Positions On Radio Signals" Nelson, *CQ*, March 1952 p.16.

Accuracy of Present Warnings

For the period July 1, 1954 until June 30, 1955 the North Atlantic Radio Warning Service of the National Bureau Of Standards achieved the following accuracy on its short-term forecasts. Accuracy of the forecast is based upon the forecast quality rating (on the NBS scale of 1 to 9 discussed previously) as compared to the rating given the day as a result of observations of actual radio circuits. Data for this comparison appears in the *CRPL-F* series entitled "Ionospheric Data."

(Forecast 1-4 days in advance)
Perfect correlation: 202 days, 55.5% of the time
Correlation within one rating: 330 days, 90.5% of the time
Incorrect forecast: 35 days, 9.5% of the time
(Forecast 4-7 days in advance)
Perfect correlation: 172 days, 47% of the time
Correlation within one rating: 330 days, 90.5% of the time
Incorrect forecast: 35 days, 9.5% of the time.

It would appear from this comparison that at the present stage of the art, short-term ionospheric disturbance forecasts can be made up to 7 days in advance with an acceptable accuracy (within one rating scale) for at least 90% of the time.

On the long-term forecasts, made 25 days in advance, the National Bureau of Standards accurately predicted about 40% of the disturbances that were observed between July 1, 1954 and June 30, 1955. Eighteen days during this period were forecast disturbed but actually were observed as normal.

The *CQ* long-term forecasts have about the same degree of accuracy. Over the past two years about 55% of the disturbances that occured were accurately predicted. On the other hand several disturbances that were forecast never materialized. The accuracy of the *CQ* predictions for periods of good propagation conditions have been considerably more accurate, being on the order of 80% or so, but this is to be expected since normal conditions exist for a considerably greater period of time than disturbed conditions. The trick is really to forecast the disturbance . . . and forecast it accurately well in advance.

Forecasting at present is therefore a rather complex procedure based on a combination of solar, ionospheric, radio and magnetic observations. The accuracy presently attained in short-term forecasts, while satisfactory, is not perfect and long-term forecasts are considerably less reliable. At the present time forecasts are based

[*Continued on page 106*]

QSL Contest Winner . . .

W2ZXL takes the 2-year subscription prize this month, with the DX amateurs still in there solidly with three of the five runners up. Nobody seems to be about to run out of ideas. Have we seen yours yet?

and runners up . . .

When you've got it up this far your worries are over.

Hoisting the Big 64

The Big 64 being pulled into position after an adjustment.

V H F

Reported by Sam Harris, W1FZJ
P.O. Box 2502, Medfield, Mass.

Every now and then you run across someone whose enthusiasm for his hobby wins your admiration. My hat's off this month to WIUHE of North Tiverton, R. I.

Norm doesn't live on a mountain top and he isn't running a kilowatt. I doubt if his antennas will ever win a prize as "Largest in their class" and sometimes I wonder if his receiver has had all its db's cleaned out. *But* when it comes to dogged determination to build up a clientele on 220 Mc he really takes the prize. It's a rare evening of operating on the VHF bands in the New England area when you don't hear someone ending a contact to keep a sked on 220 with Norm.

However sitting on a dead band calling CQ and waiting for sked time to come up is not Norm's way of operating. His quest for contacts takes him to Six Meters and a whole new field of activities in order to stretch his 220-Mc ground wave to new areas. He works cross-band contacts, and he uses the telephone and the mail box. Rather than complain about the lack of activity he *DOES SOMETHING* about it. I don't know nor care if Norm is a Technician or a General Class or maybe even a Grandfather Class. I'm sure of one thing. Norm is a *HAM* and he's the kind of ham that makes me proud to be one.

I have been fortunate enough during the last month to have the opportunity to test some commercial VHF gear. Among the most interesting to me was the WRL six-meter converter. To be perfectly frank I wasn't particularly impressed by the package and as a result I didn't expect any astounding results. I was pleasantly surprised therefore when the converter performed amazingly well.

No circuit or operating instructions were available when the tests were started and considerable time was consumed in determining the proper voltages etc. B+ to the unit was varied from 75 volts to 300 volts while the noise figure was being measured. A noise figure of about 6½ db was obtained on each end of this range with a dip in the center to about 3½ db. Optimum NF occurring at about 185 volts. Despite this good showing on noise figure, however, the converter appeared to lack sufficient gain to turn in a good performance when used in conjunction with a receiver having only one r-f stage. After some head scratching I switched the converter onto the input of my NC-300 and found the answer. This astounding piece of information led to a complete overhaul of my NC-240D including the installation of a new low-noise front end. Apparently the boys at WRL laboratories designed this gadget to work with a good IF receiver and figured if the eventual user didn't have one he ought to fix it (a line of reasoning with which I heartily concur). In any event the performance of the converter when used with an adequate IF system leaves little to be desired.

I would list the following good points for

ARRL VHF Sweepstakes
FLASH RESULTS

Here are some of the top scores of the January 7-8th Contest.

W1FZJ	E Mass	12	161	3864
W1HDQ	Conn	13	229	5954
W1LUW	E Mass	6	100	1200
W1OOP	E Mass	8	171½	2744
W1PYM	E Mass	6	120	1440
W1REZ	Conn	12	152	3648
W1RFU	W Mass	13	241	6266
W1RUD	E Mass	9	135	2430
W1VIY	Conn	11	148	3256
W2BVU/1	Vt	9	86½	1557
K2BC	No NJ	6	160	1920
K2CMB	No NJ	9	209	3762
W2ALR	WNY	7	90	1260
W2CXY	No NJ	15	158	4740
W2HBC	E NY	8	148	2368
W2KIR	NYCLI	10	137	2740
KN2MYS	NYCLI	6	94	1128
W2ONV	No NJ	10	180	3600
W2PRF	No NJ	11	265	5830
W3IBH	E Pa	10	224	4480
W3TDF	E Pa	13	201½	5239
W8IJG	Ohio	5	146	1460
VE3AIB	Ont	4	48	384
VE3AQG	Ont	5	77	770
VE3DIR	Ont	8	72	1152

From W6AJF:

Apparent leaders in Sweepstakes contest are W6EXX with 130 stations SCV section, W6MXQ with 120 in EB, W6AJF 110 in SF and W6CDT in SV section. Low pressure storm area limited 144 and 420 band distances to 40 percent of normal. About 60 stations on 50 Mc., 120 on 144, 2 on 220 and 15 on 420 bands in this area.

the converter.

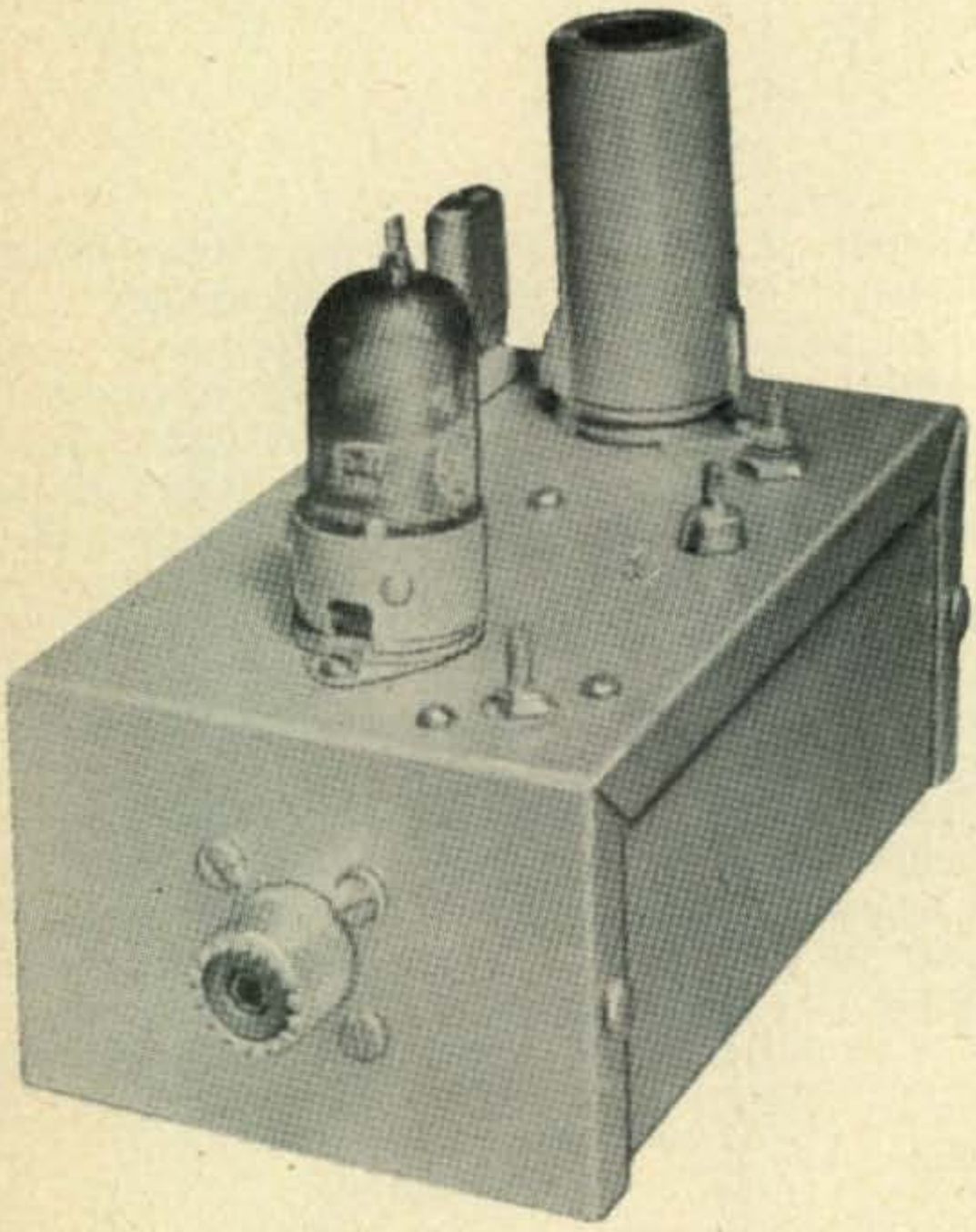
1. Noise figure: More than adequate for the band conditions encountered on Six Meters.

2. Gain: Adequate for use with any receiver of modern design.

3. Birdies: None when used with a receiver having the local oscillator on the high side of the tuning range.

4. Bandpass: Flat within two db over the range of 50 to 54 Mc.

5. Image rejection: Better than 50 db when used on the IF range recommended by the manufacturer. (Considerably better when used



The WRL 6-meter Converter.

in conjunction with the NC-300 with an IF 30 to 34 Mc.)

On the bad side of the ledger I would say the only points worth mentioning were a tendency toward overloading on strong signals and a lack of an adequate way to ground the chassis to the receiver. The tendency to overload is of no importance unless you happen to live in an area blessed with the benefits of a TV station on channel 2. Fortunately the Boston area six-meter boys are only afflicted by this malady from 6:00 to 9:00 in the evening. This, however, is a poor time to be off the band as a considerable amount of the local activity occurs during these hours. After proving conclusively to myself that the fault lay in the converter and not the TV station the converter was opened up and some time was spent trying to cure the fault without spoiling the other good things. For instance a high-*Q* coil in the front end is a sure cure but the bandpass is narrowed to the point where tuning of the band requires continual retuning of the coil. For western-type six-meter men this would not be any problem but in this neck of the woods it pays to tune the whole band. A good low-pass filter is another sure cure but the converter can ill afford the loss in signal unless a high gain i-f system is used. The best solution was found by cleaning up the wave shape of the xtal oscillator and providing some additional shielding between the oscillator and the cascode input stage. Apparently the majority of the trouble is occasioned by the second harmonic of the local oscillator mixing with the TV signal in the input stage. The modifications are simple and the cure is complete.

As far as the lack of adequate grounding facilities is concerned I can only say the obvious. Who *does* supply them?

Personally I like the converter and the XYL threatens to beat me every time I mention sending it back. (Editor take notice)

Six Meters

Speaking of Six Meters (we were, weren't we) the XYL (Helen) and myself have been having a lot of fun on this band. Local activity is very good and ground-wave contacts up to 300 miles are quite frequent. At the present time my six-meter antenna is still on the ground and we are using the two-meter beam. However, after hearing how successful Ed (W1HDQ) has been on his tests with W4HHK I am filled with ambition and expect that by the time you read this I will have a 32-element fixed beam pointing in the general direction of Tennessee. Anybody on the line between western Tennessee and Boston, Mass. looking for a lot of fun playing with meteor scatter signals is welcome. Please address your inquiries to *WIHOY*, P. O. Box 2502, Medfield, Mass. (The XYL is very touchy about *whose* station is on Six.)

Visits

Going to see the other fellow's station always lets you in for a chance to learn something new. A visit to Ed Tilton's home in Canton, Conn., was a real treat for Paul (W1PYM), Bob (W1RUD), Sully (W1DDN), Helen (W1HOY), and myself. We met Ed and his XYL at the La Salle street headquarters of the ARRL in West Hartford. A tour thru the building where the business of the League is conducted was very educational and gave us a picture of where our money goes. (It's not as bad as the Pentagon, fellows.) The equipment testing laboratory was the principal point of interest for most of us. Here, in a well equipped, nicely laid out, amply-proportioned lab, the gear that you and I are likely to be purchasing in the next year or two is set up and given the once-over by the experts. Here also the new equipment that will appear in the Handbook is built and tested. (I was discouraged to note that there was no sign of any new receiving gear for VHF.)

From the League Headquarters we (after eating a sumptuous meal) adjourned to Canton and the home of VHF itself. Among other things we got a good look at Ed's new stacked six-meter beam the likes of which he expects to give an article on soon. For those of you who haven't talk to Ed on Six the new beam consists of two 3-element wide-spaced parasitic beams stacked ⅝ wavelength apart. The results are nothing short of terrific. In addition to working well it is a practical antenna to put up. (Quite unlike the monstrosities that grow at my place.)

Ed was also enjoying the benefits of a new Hallicrafters SX-100. In the little time I had to tune it I was very impressed by its ability to dig in and make readable those weak ones. Wonderful selectivity and good bandspread. Only objection was the usual wet string feel of the dial. The appearance of the beast is very pleasing and I think that the boys at Hallicrafters have got a real comer in the '100."

KW on Six

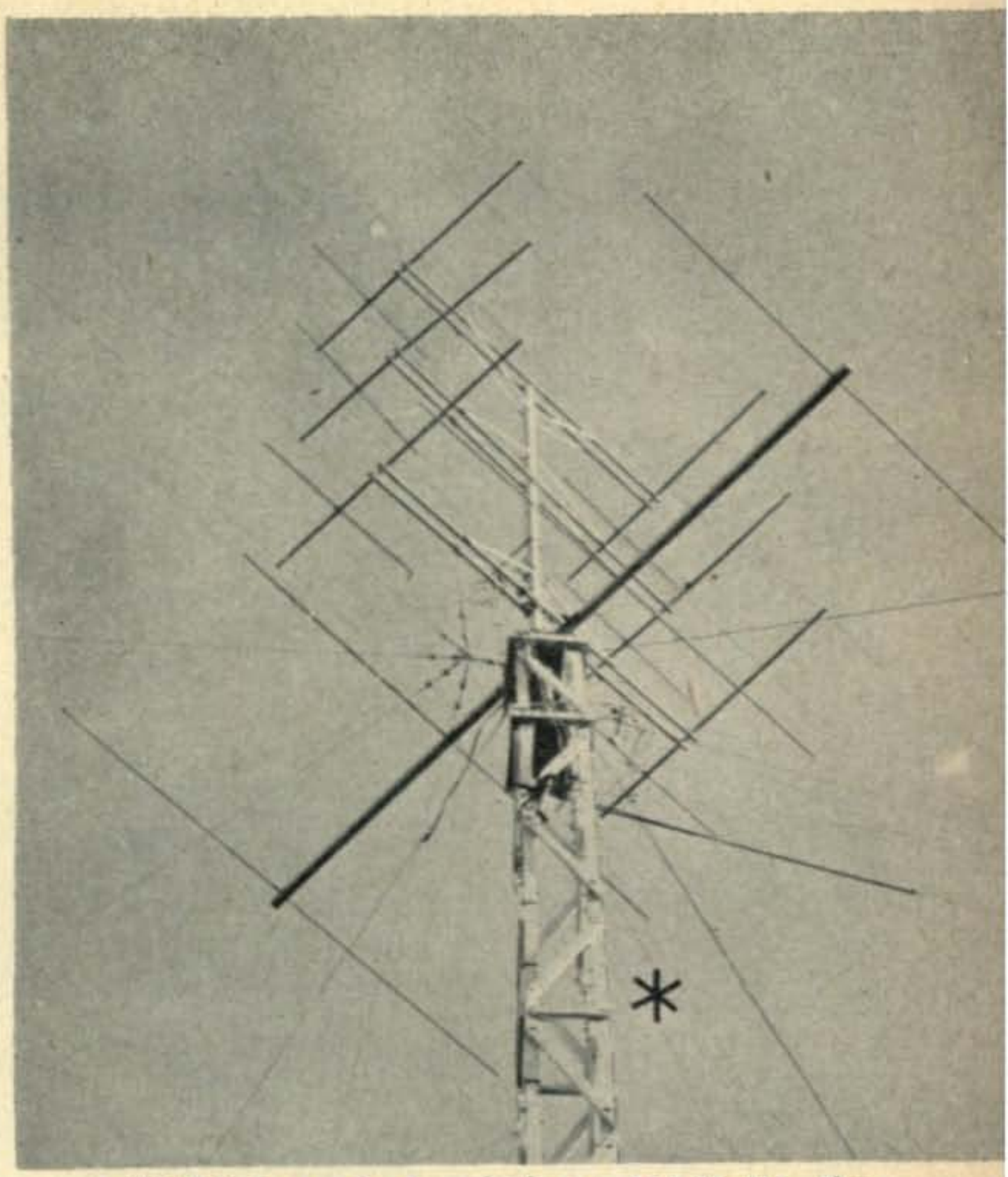
Another item of interest was Ed's new high-power final for Six. It really doesn't qualify for the title of "new" as it is a reworked version of the handbook 4-125 final with a 4-400A doing the RF-making. Still had a few bugs in it but it shows signs of being a hot six-meter final. While I think that there is plenty of room on Six for low power and small antennas it is certainly true that the band will never come into its own until we have given it all the law allows in the way of high power and big beams. Ed's new final is certainly a step in the right direction.

Didn't realize until now just how short we have been on six-meter news and views. Now the XYL (W1HOY) is on Six Meters and when we looked through the correspondence for six-meter information, we found we had practically none. I'll start this ball rolling by going through Helen's log and notes. Let's see what I can make of them. . . .

One of the regulars who can always be counted on to keep skeds is K2GRI located in Porter Corners, New York. Dick is an old-timer in VHF work and he really works at it. He's one of the boys who gives Norm (W1UHE) skeds on 220 Mc. Keeps all the local boys around Boston working on their equipment too. (Seems as how his signal is just about noise-level quality on a good normal night.) Early morning or late at nite Dick is there and ready.

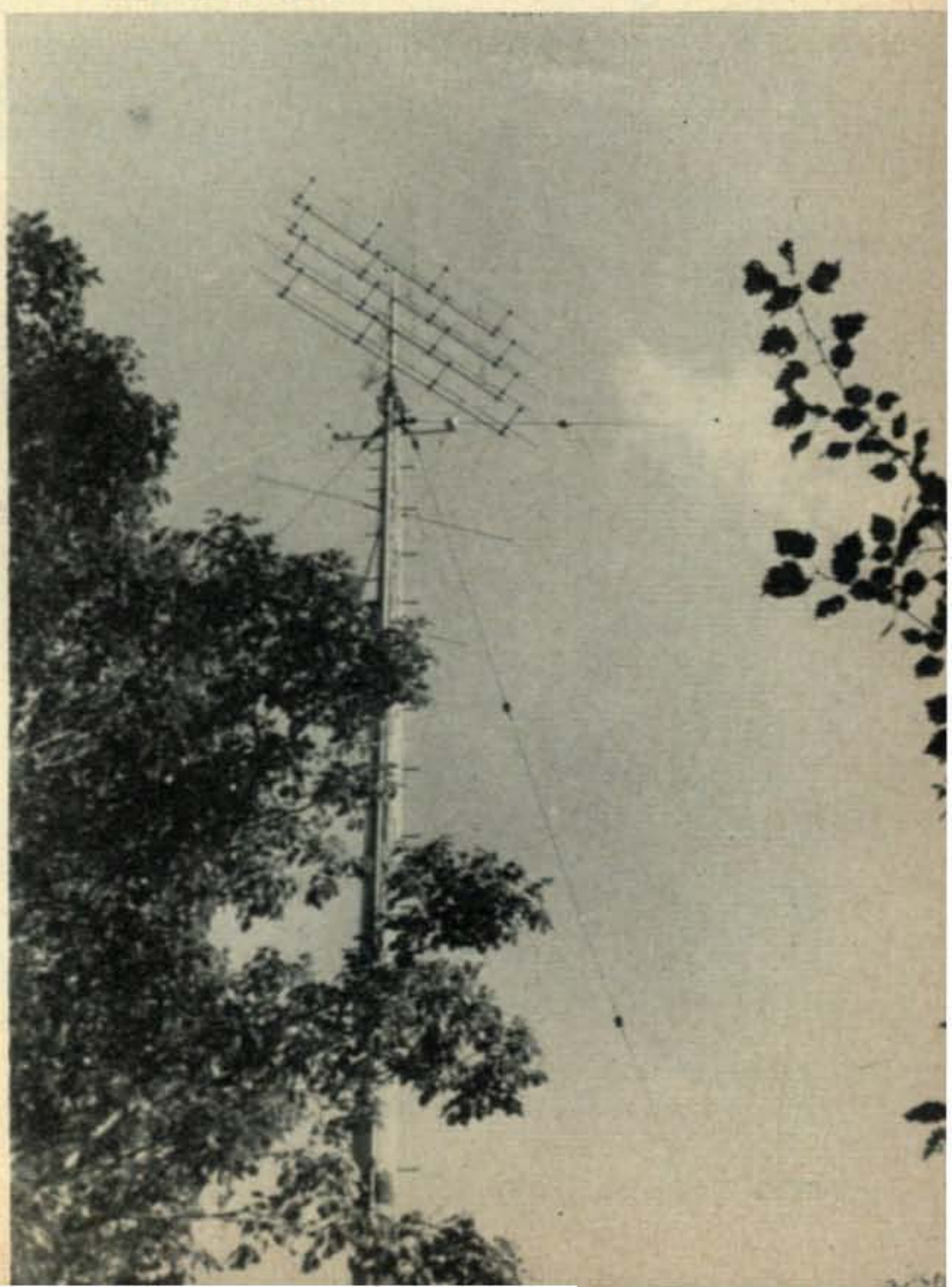
Nets

Can't hardly get on any more without running into one of those Night Owl boys either. The Night Owl Net, sponsored by no one in particular and generally M.C.'d by Allan (W1VSV) and certainly attended by such notables as W1UVB, Reading, Mass., and many others too numerous to mention, has



JK3ATN is ready for skeds on 144.42 Mc. The top array is 6 five-element "brownies" for Two Meters.

Just in case you don't think they make them big in Wisconsin. Harold (W9BTI) of Milwaukee has this to offer.



sparked the local activity to the point where a contact is as easy to make as it is on Two Meters (well, almost). As a matter of fact, I did hear someone the other day talking about some lid who must be a refugee from 80 Meters. Claimed he heard this lid working CW in the fone band (OY, OY, OY!).

Can't talk about six-meter activity without mentioning Austin (W2SYR) in Towaco, N. J., and Ralph and Lee (W2FBZ), East Orange, N. J. These two stations supply the six meter DX for the boys in the New England area (ground wave that is). Sure is good to hear you folks on down there. Hope you keep pointing your beams up this way once in a while.

Two Meters

Reports from all over the country indicate a slackening off of activity on the old home band. Bob (WIUDR) has been active in the Boston area with a new high-power final and a new antenna. His efforts to get the attention of the N. Y. and N. J. boys sounds like an episode from *Tom Swift and His Electric Rifle*.

My present activity on Two has been pretty well curtailed due to the efforts we are making to get up some new antennas. Among other things we are hoisting up four of those long, long, long Johns.

I don't mind putting them up but I don't want to go backward. Believe me all is not beer and skittles on this project. For instance, the

Ye honourable editor, W2NSD, talks over a low-pass filter with Hank (WIOOP). The scene is the operating position at WIOOP.

first long John (all 30 feet of it) had a beam width of 20 degrees at the half-power points and a front to back ratio of 30 db at its tuned frequency. On paper this figures out to be a real beam. Only one trouble—Its gain compared to a half-wave folded dipole turned out to be a thumping 3 db! A more detailed story is in the making. Hope to have it for you next month. Meanwhile beware the long-John pusher who proves his point with pencil and paper. Look for the results before you jump.

Contest

Plans for the Spring Contest are almost completed. Hate to mention it so soon after the January go we just finished but you know how it goes. Just have to keep Old Smoke busy doing something.

The SSW contest closes with the December listing and the top scorers for the year will be listed in the March issue. Future issues will carry a listing of the VHF WAS certificate holders. (More on these certificates in the next issue.) Participants in the SSW contest need only advise of the new states they have worked. All others need only send a list of the states claimed and the station worked in each state.

Cooperation

During the past half year or so I have been trying to give you a column in which you would be interested. How well I have succeeded has in a large measure been up to you. Your letters and suggestions have been the framework around which this column has been formed. I am sorry that I have not been able to be active on more of the VHF bands than I have, but like everybody else I have to make a living and my operating time if anything is decreased by my efforts on the column. Nevertheless I do hope to be on 220 Mc. and 432 Mc. before Spring. Meanwhile my only method of spreading the word about these bands is through your cooperation. Soooo, if you don't see it in the column it's because you didn't write in about it. Go ye and do likewise. . . .

To those of you who have written so many letters in the past six months, a million thanks. Keep up the good work and I'll keep on trying to get the news and information disseminated to the faithful. . . .

Letters to Ye Ed

Ithaca, New York: Contest-man, Walt (W2WFB), sends us the following:

"Two-meter activity is at a new low here in Ithaca, hence the low score. During meteor skeds November 14, 15, W4HHK got a *fifty second* burst from me. I got only one short one from him. Am looking for hi-power 50 Mc. stations with whom to run tests on ionospheric scattering. Have K.W. final ready and antenna on the way. Optimum range is six hundred to thirteen hundred miles."

Glad to hear of your six-meter activity, Walt, the XYL is ready and waiting for skeds, too.

Marvin, South Dakota: Bernard Lane (WØRSP), informs us that he has a new ham on two in that vicinity. The new call is WØYEJ. *Welcome to the band O.M., the more the merrier.*

Clearfield, Utah: W7QDJ says:

"Yes, they're using vertical in the Salt Lake Valley and it cuts my signal way down when I go horizontal. On Six they're also using vertical, but I don't go along with them on that."

We think that half the fun of ham radio is doing what the other boys aren't doing O.M., so we say, go ahead and work with the horizontal for a while, see what results you get. We say the same thing to the vertical man who lives in horizontal territory. We'll never find out much if we don't go ahead a little on our own. Good Luck.

Los Angeles, California: One of our few YL contributors has written us a brief account of her activity. Irma (K6KCI), says:

"Think the low score this month requires an explanation. I have been made NCS for the American Legion two-meter net one night a week and also NCS for the 2 x 4 traffic net.

Congratulations, Irma, we know you'll do a good job.

"A lot of the fellows have found out about the contest now *and about time too, I'd say* and make a point of calling me. I work only two-meters as we are in a rather congested area. There is a lot of two-meter activity here and loads of YL's and XYL's now have licenses. My next month's score should be super as some of the boys are planning jaunts to Nevada and Mexico and have said they'll be sure to try to work me."

We're already watching for your next scoresheet. Hope they come through O.K.

Ithaca, New York: Additional news from Walt (W2WFB):

"Concerning the opening of October 11th and 12th: spent October 10th listening to W8's working WØ but nothing here. October 11th the western New York stations were working Mississippi, Arkansas, Alabama and Missouri, but heard nothing here in central New York. Finally heard and worked W4HHK for a new state shortly after midnight. Heard no other DX so guess I was barely on the edge of it. Paul said he heard no stations farther east than here. Nothing at all the next morning. Am looking for skeds with West Virginia and Delaware. Anybody on?"

Well?

Provo, Utah: Steve (W7VEW), comes forth with:

"I've tried very hard to get the VHF boys on

for the contest but had little luck.
Aw, c'mon fellas.

"Our QTH is about forty miles south of Salt Lake City and there is a 12,000 foot mountain in the way of working a great many of the fellows.

"My gear here is two ARC/5 transmitters, two 522's; also 522 and ARC/5 receivers. I also have a Gonset Communicator and a mess of ground planes.
Can't say he ain't trying, boys.

"We have ten fellows here with VHF gear but they seldom get on, however I'll get them all on in December or die trying."
Poor time for a FUNERAL, Steve.

Metamora, Illinois: From the cold, cold State of Illinois, "Hod" (W9ALU), melts the ice from his fingers, takes his pen in hand and writes us a missive, which follows:

"I have made two changes in my Tecraft 144 Mc. converter which may be of interest to the gang.

"The 6BZ7 cascode first RF stage was changed over to a 417A grounded-grid by lifting all connections from original circuit except plate. Since the tube socket is correctly oriented, the input coil is connected to cathode through a hundred ohm resistor, paralleled by suitable capacitor. One heater is grounded and the other is fed 6.3 through rf choke. A small copper shield separates input and output. The grids are grounded to this shield.

"The second change resulted in a change-over from pentode mixer to triode connected 6CB6. The screen grid and suppressor are connected to plate after disconnecting screen dropping resistor and by-pass capacitor. I also tried high-mμ triode but with no results comparable to low-mμ. It is possible that by reversing the socket a 6J6 could be used with even better results.

"This second change came about when a newly acquired KP81 was used as 14 Mc. IF system. With my Tecraft with 417A front end, the no signal noise was R5. A home-constructed Wallman converter belonging to a good friend had a R2 no signal noise level on the meter. Upon reworking the mixer, the noise level has dropped three R units and I can hear more stuff even off ends of beam with BFO. Last night (Nov. 23) W9GLR made similar change with comparable drop in noise level."
Very good information "Hod," we haven't checked this ourselves as yet, but will let you know if we get the same or similar results.

Trumansburg, New York: W2SHT, Henry, is trying to solve a problem for the VHF men and has let us in on the following:

"I notice several fellows are eager to get 417A's on but being as they are so hard to get and expensive, I am working on a substitute. My new converter (almost done) has two 6AN4's ($2.50) each in a cascode, then the 6AK5 amp and pentode mixed that I like and works very well into a 6C4 cathode follower output with the 12AT7 osc, multiplier included. I think that it will be comparable with the 417A's not as expensive or scarce, and not as critical. The whole converter is built in a small cabinet with power supply.
WE'd like to know how it comes along, Hank, maybe you could write an article when tests, etc., are completed.

"My rig is an 829B in a Millen VHF amp. Converter is one that I cooked up using a 5670 cascode into a 6AK5 amp. into a 6AK5 pentode mixer and a 12AT7 osc. multiplier. This outfit works very well, it is in a minibox 10x1½x1½. A long John, Hi."

Tujunga, California: A sunny Californian, Dan Ross (W6SDW), comes through with some contest suggestions:

"Our local ham group, the Sunland Tujunga Amateur Radio Society, is mainly interested in VHF contests. Although we do not score high, we show up at every contest under the call of one of the members.
Which member's call is being used in the SSW Contest, Dan?

"A possible method of scoring has occurred to me. If you count the number of points per contact as distance (rounded off to nearest ten miles, with a minimum credit of ten) divided by thirty for six-meters, divided by ten for two-meters, by seven for four-twenty and two-twenty, by two for 1215, and by one for all higher bands, the contests would be equal for participants in all parts of the country. Bookkeeping would be simpler if the total mileage on each band were divided by the band division.

"Power multipliers should be given for the QSO parties, but not for the sweepstakes. Another multiplier of 3/2 should be given in

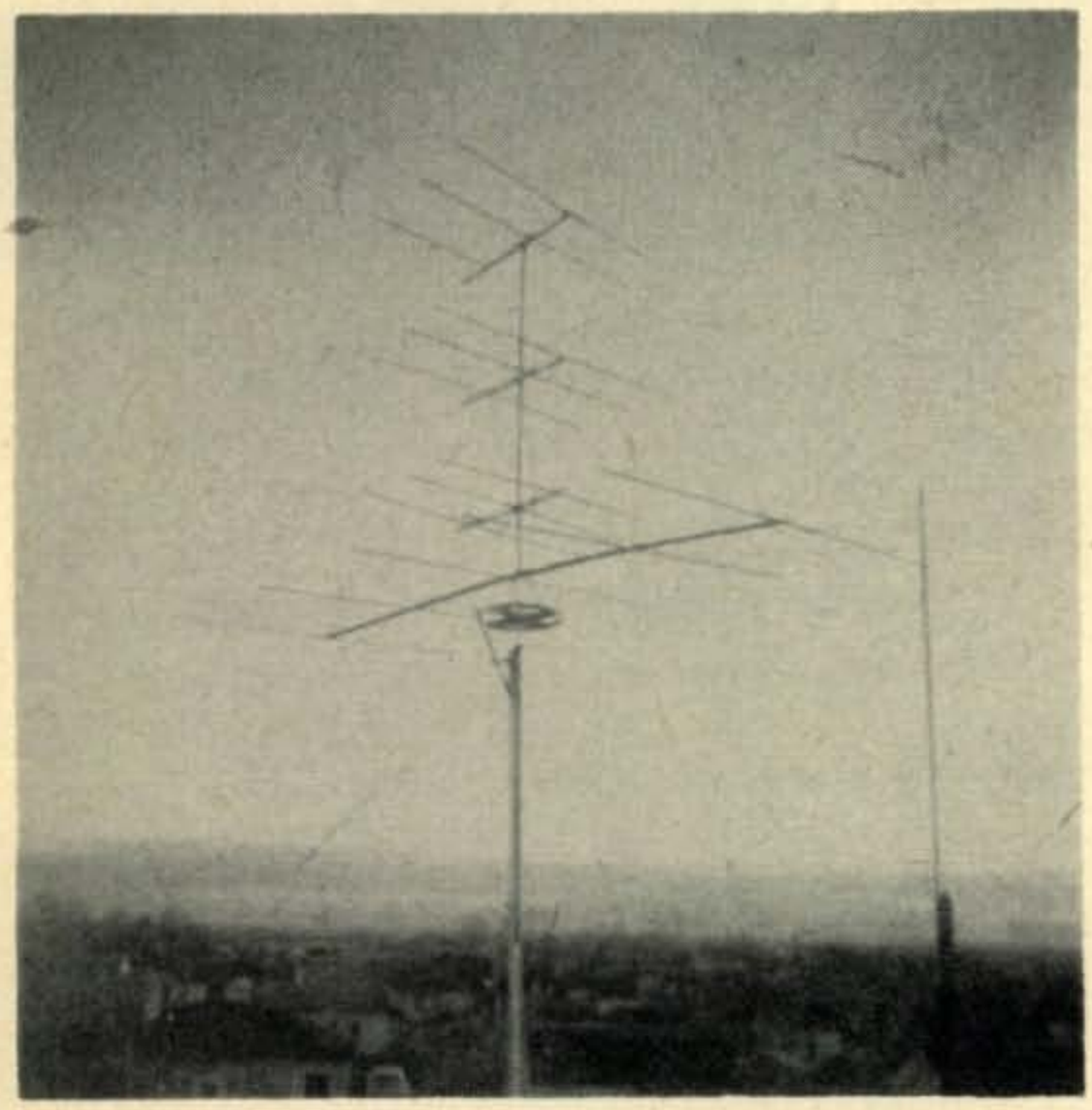
K2GLS ready to go.

all contests for homebuilt gear, and 5/4 for partially homebuilt gear (not including the antenna)."

Sounds good here Dan, how about the rest of you fellows, any comments?

Deland, Florida: Very seldom that we hear from Florida but Gene (W4YGT), sent this missive:

"We in Florida enjoy your VHF column in *CQ* magazine very much; however, we think



Anybody for Utah on 6 or 2? W7QDJ of Clearfield uses 5 over 6 over 6 on Two, 5-element beam on six.

that you should also include *our* activities on the higher frequencies.

Only too glad to do so Gene, if someone will only tell us about your activities.

"Florida is becoming very active on two-meters—the following stations are on the air practically every evening: W4VXZ, George, Deland, Fla., 144.00, A3, Horizontal Polarization—W4DQT, George, Orlando, Fla., 144.2, A3, Horizontal Polarization—W4QN, Hal, Orlando, Fla., 144.2 NBFM, Horizontal or vertical —W4TBH, Johnny, Orlando, Fla., 144.45, Gonset Communicator, Horizontal—W4QR, Deland, Fla., 144.00, A3, Horizontal—W4YJM, Ivan, Orlando, Fla., 144.2, FM, Horizontal—W4CSS, Fritz, Orlando, Fla., 144.2, A3, Various antennae—W4YGT, Gene, Deland, Fla., 144.00, FM, Horizontal. Usual operating time is 9:00 P.M., EST.

"If and when you get ready for the *Florida to Maine relay*, just let us know.

"Does anyone want Florida on 420?"

Thanks for all the information on the VHF gang out your way, Gene. I take it that you're ready for skeds on 420.

Providence, Rhode Island: "KC" (W1KCS), finally broke down and wrote us a letter giving us temporary heart-failure and then the urge to strangle him when he came through with details:

"Been meaning to do this lo these many months, since *CQ* took on the 'Big Change.'

"Well, finally did it, worked WØETZ last night (December 4) beautiful signals too—got your breath yet? Bill was driving up from Plainfield, New Jersey to New Bedford, Massachusetts. He was looking for you.

Where could I have been?

"While talking to Bill, I couldn't help notice how swell a signal his Gonset was giving me, and Horizontal too. He's using a circular antenna on his ten-meter buggy whip. There were no complete or even bothersome wash-outs in his signal and very little fluttering.

"Been on VHF since 1936, first rig was a pair of O1A's on Five Meters, and have finally arrived in the top level after winning nine section certificates in VHF contests. Is it time to retire now?

Oh no, not that, "KC"!

"Anyone got ideas on how to get rid of those TV oscillators on 220 Mc.? I want to put some serious thought into that band."

Tulsa, Oklahoma: Wendell (W5VKH) sez:

"Wanted to let you know that all is not quite dead on VHF here in W5 land.

We were beginning to wonder, Sparky.

"During the month of November, conditions on two-meters were stinko, but things seem to be looking up in December. Activity is down, however, and for this reason it is hard to check on conditions. I have made a couple of contacts with WØZJB this month and of course local contacts with W5NDE.

"A word or two on the Tulsa trio on two meters.

"W5DFU bought the next to the highest house in the city, in order to outdo the others of our faithful few. He has not been getting too much done about getting back on the air, and therefore cannot prove as yet that the move is going to benefit him.

What these VHF men won't do, just to get a good location, a good signal report, and SOME DX.

"W5NDE who has a rig capable of running the legal input (without too much output) has the big rig down while he is building up an 826 driver stage. He uses VT227's in the big final as grounded grid amplifiers. He is presently on the air using only his first buffer stage consisting of an 829B. The lines (in the big rig) plate, in the final are three inch diameter copper pipe.

Get that big one back, OM, the boys in your territory need to hear your powerful signal.

"W5VKH (that's me) is still plugging along with the 829B final, eighty watts input, sixteen element colinear, forty-five feet high. I have worked west to Buffalo, Oklahoma, (W5HGH), North to Conway, Iowa, (WØGUD), east to

[*Continued on page 113*]

7th Annual YL-OM Contest

Dates: Phone—Starts Sat. March 3, 1956, 1 p.m. EST. Ends Sun. March 4, 1956, 12 midnight EST.
CW—Starts Sat. March 17, 1956, 1 p.m. EST. Ends Sun. March 18, 1956 12 midnight EST.

Eligibility: All licensed OMs and all licensed YLs.

Operation: All bands may be used. Cross-band operation is not permitted.

Exchange: QSO number, RS or RST report, State, U.S. Possession, VE District, or country.

Procedure: Call "CQ YL" or "CQ OM."

Scoring: One point is earned for each station worked, YL to OM or OM to YL *only*.
Phone and CW sections will be handled as separate contests. Stations and multipliers will count only once in each contest; example: a station contacted on phone may be contacted in the CW portion of the contest for additional credit.
Add number of points and multiply by number of different States, U.S. Possessions, VE Districts, and countries worked.
All phone contestants running 150 watts or less input at all times may then multiply final score by 1.25.
All CW contestants running 150 watts input or less at all times may then multiply final score by 1.25.
Maryland and District of Columbia count as one state.

Deadline: For logs. *Phone* not later than April 1, 1956. *CW* not later than April 10, 1956. Send logs directly to Gloria Matuska, W9YBC, 2322 South Second Ave., North Riverside, Illinois.

Awards: Silver cup to the YL and OM attaining the highest overall scores. This can be a total of Phone and CW scores, or may be obtained by one mode of operation only if this score is higher than any obtained by both modes of operation.
Phone: Gold cups to the YLs and OMs earning first and second places.
CW: Gold cups to the YLs and OMs earning first and second places.
The winners of the highest score cups are not eligible for any other awards.
All winning contestants will receive a certificate.
The highest scoring contestant in *each district* will receive a certificate.
The cups are awarded on a yearly basis with a three-time winner obtaining permanent possession.

Monitored by
Louisa B. Sando, W5RZJ
Jicarillo Apache School, Dulce, New Mexico

7th Annual YL-OM Contest

Time again for the increasingly popular YL-OM Contest. As last year, the contest will have separate weekends for phone and CW operation. The phone section is scheduled for March 3-4. The CW section will be held two weeks later, March 17-18. You'll find lots of the gals operating on these weekends so it will be a fine chance to make contacts toward the YLCC and/or WAS/YL awards offered by YLRL. Rules are given in the separate box.

A YL Enters a Contest

Contests must be a cinch for the OMs—in one way at least. Their wives keep the household running smoothly, often serve coffee and/or meals in the Hamshack, and the jr. ops are ushered safely out of earshot. But how many realize what the YL runs into when she enters a contest—especially if there is a jr. op or two around?

W9YBC, Gloria Matuska, has written this version of what happens when a YL enters a contest:

"It all started when a local club sponsored a

Enjoying the luncheon celebrating their first year on the air are these members of the Texas YL Round-up Net. L. to r., seated: W5's LGY, WXY, SYL, ZPD; second row: BDB, K5BNQ, W5IOZ, ILO, RYX, YKE; back row: PFU, Vesta Winters, YRT, EGD.

WØZWL, Martha, Shirley, licensed for 18 years, is active on 80, 40, 20 and 10.

contest. We were to get as many contacts as possible in a week's time.

"CQ CQ CQ—my first contact was a VE3—that looks good in the log anyway. I worked till 3 a.m. Finally decided to get some rest as the jr. ops would be up on sked. 7:30 a.m. and I was back in the basement Hamshack calling CQ. This was Sunday and the OM had taken over. I had prepared the meals in advance and we had a quick dinner. This day progressed FB.

"Monday and I was on my own. I sent my daughter, Bunny, off to school at 8:30 a.m. and rushed down to the Hamshack with a box of toys and a bag of potato chips to entertain 3-yr. old Skipper. To make sure he wouldn't get into mischief I locked both of us in the Hamshack and put the key on the operating table.

"Happened to hear a Canadian YL on 40 phone and while I was talking to her was invited by another YL to join in a ragchew a little higher in frequency. I had such a wonderful time talking to the YLs I neglected to notice what my son was doing. After separating about a pound of tiny screws from the bag of potato chips and picking up odd bits of chips all over the floor, I hit my head on the vise of the workbench and sat down and bawled for ten minutes—my son joined in with some beautiful howls. After I forgave him and tried to get out of the Hamshack to make Bunny's lunch, no key. . . .

"We looked for it for about 20 minutes, all the while I was getting more panicky imagining all sorts of things. Skipper just didn't remember where he had put it. Finally I found it—without my noticing him he had slipped the key under the receiver. But to my dismay I found he also had filled the lock with tiny screws! With the aid of a pick, screwdriver and a few unladylike words, we got out in time to fix lunch for Bunny.

"You might think that I would give up, but I didn't. After lunch and my jangled nerves had settled down a little I thought I'd have another go at it. So I carried down rugs and blankets and, with crossed fingers, hoped Skipper would take a nap on a make-shift bed, while mama talked to the Hams. Well, he was tired, but the telephone kept ringing and the doorbell, too, and each time he would get up to tell me about it and each time it would be

A YL enters a contest.

just a little harder to get him to go back to sleep.

"Getting most of my contacts on CW I couldn't have him interrupting all the time so finally I gave in and said he could play on daddy's workbench—much to his delight. It was not until later that I realized just why he was so good. That was when the OM (W9ATW) informed me he'd prefer I did not enter any more contests for a while—Skipper had poured lighter fluid in daddy's tobacco!

"Incidentally, I came in second—the winner had only 7 more contacts!"

"SW"

Long has the battle raged (verbally) over the terms YL, XYL and such suggested others as MYL, SYL, OG, Hamette, Hamess, etc. We still concur in the majority opinion that a licensed feminine radio operator should be called a YL (Young Lady)—whether she be single or married, young or not-so-young. It has been the non-Ham wives of radio amateurs who have objected to the tag *X*YL. Now we have run across an abbreviation for these XYLs that seems to us to be the perfect answer—short, easy, *and* flattering. It is "SW" and means "Sweet Wife"!! This "SW" abbreviation already is in current use among the ZS amateurs and appears in print in the South African amateur magazine *YL Beam*. With usage it could easily catch on and spread throughout amateur radio all over the world. How about it, gals—wouldn't you be glad to be called an "SW" (Sweet Wife) instead of an *X*YL?

Texas YL Round-up Net

Members of the Texas YL Round-up Net celebrated their first year on the air with a luncheon at the Baker Hotel in Dallas on Nov. 19. The 13 licensed YLs attending included: W5's WXY, president; SYL, vice president; LGY, secretary-treasurer; ZPD, publicity chairman; BDB, EGD, ILO, IOZ, PFW, RYX, YKE, YRT, K5BNQ. The girls changed their net time to 0800 CST due to poor reception on 75. Also, for the YLs who work or go to school, a net time will be held on 3880 kc. Thursday evenings and a continuation of the net started on 40 meters was voted on, to be held on 7236 kc at 1000 CST on Thursdays. YLs outside Texas are invited to join in.

The Texas YL Round-up Net started with the idea of a YL club in Texas by Pat, W5TTU, but the first meeting was unsuccessful. Then the Dallas area YLs went on the air to organize

[*Continued on page 114*]

"Mike" in each hand. W5TDM, Jan, holds 36-hour old son, Michael, born to her and OM W5RHW on Nov. 25. Transmitter is remote controlled job, 60 watts, with a 2-element colinear antenna 250-ft. high (on top of the Fifth Ave. Clinic in Ft. Worth). W5RHW, "Doc," had remoted it from their QTH but with Jan in hospital he moved the control head to her room where she enjoyed 10-meter ragchews. Photo by W5CRK.

RTTY

as reported by

Byron H. Kretzman, W2JTP

9620 160th Ave., Howard Beach 14, N. Y.

RTTYers build. That is perhaps the most outstanding characteristic of this particular branch of amateur radio. Now, I don't mean that all RTTYers build their receivers and transmitters. Very few amateurs of this day and age build their receivers, but quite a few still build their transmitters. RTTYers build in addition their frequency-shift exciters and their RTTY converters. This is good, because it is with saddened heart that we notice so many of the new hams coming on the air with completely store-bought gear, even right down to antennas cut to the correct length. Well, those fellows are missing an awful lot of fun. RTTYers, in general, get just as much kick out of building their specialized pieces of equipment as they do out of operating on radioteletype. And they *learn* something by *doing*. The satisfaction obtained when you have perking a piece of gear that you've put together and *made to work* yourself can't compare with *just* operating.

As mentioned last month, although this column is directed largely towards the potential RTTYers, we will try to carry a bit of technical dope for the fellows already on. For example, this month's feature is the converter built by Al Witt, W9KLB, of Chicago. *Fig. 1* shows the schematic diagram. As will be observed, this converter is of the polar-type, with separate *mark* and *space* channels following the 12AT7 cathode-coupled limiter. The input transformer T1 is a plate-to-voice-coil output transformer connected backwards to permit feeding the converter directly from the voice coil circuit of the receiver. A switch and .01 μfd. coupling capacitor, C1, are provided for high impedance input if desired. While Al used 1 h. toroids, the readily available loading coil toroids, such as described in last month's RTTY column, might be substituted; however, it is suggested that W6LDG's article. "A Matched Impedance RTTY Converter," in the May 1955 *RTTY* Bulletin be read very carefully.

Once the *mark* and *space* filters have been tuned, adjustment of the converter is a simple matter. With both *mark* and *space* gain controls turned completely down, the polar relay balance control R23 is adjusted for zero current in the polar relay windings, as measured at jack J3. Then feed both 2125 and 2975 cycles (of the same amplitude) alternately to the converter to determine which channel has the *lower* diode current as measured by a microammeter plugged into jacks J1 and J2. Note this value, and reduce the gain of the *other* channel so that the diode currents are equal. Simple, huh?

The accompanying photograph shows the FM 2 meter AFSK set-up at W9KLB. The panel with the four small knobs is the converter unit. The extra jacks were left out of the circuit diagram for simplicity, in case you are wondering. Notice, particularly, the layout of the equipment. It's all enclosed, except for the meters, when the doors are shut, yet the vertical chassis type of construction makes tubes accessible from one side and the wiring from the other. This I like.

Last month some of the basic principles of RTTY operation were discussed, together with a rough outline of the technical regulations of the FCC that apply to our kind of amateur radio. For this month we will describe the vari-

AMATEUR RADIOTELETYPE CHANNELS

National, FSK (mark frequencies; space 850 cycles lower) 3620, 7140, 27,200, 29,160, 52,600 kc

National, AFSK (2125 cycles mark; 2975 cycles space) 27,200, 147,960 kc calling & autostart; 144,138 kc repeater & duplex

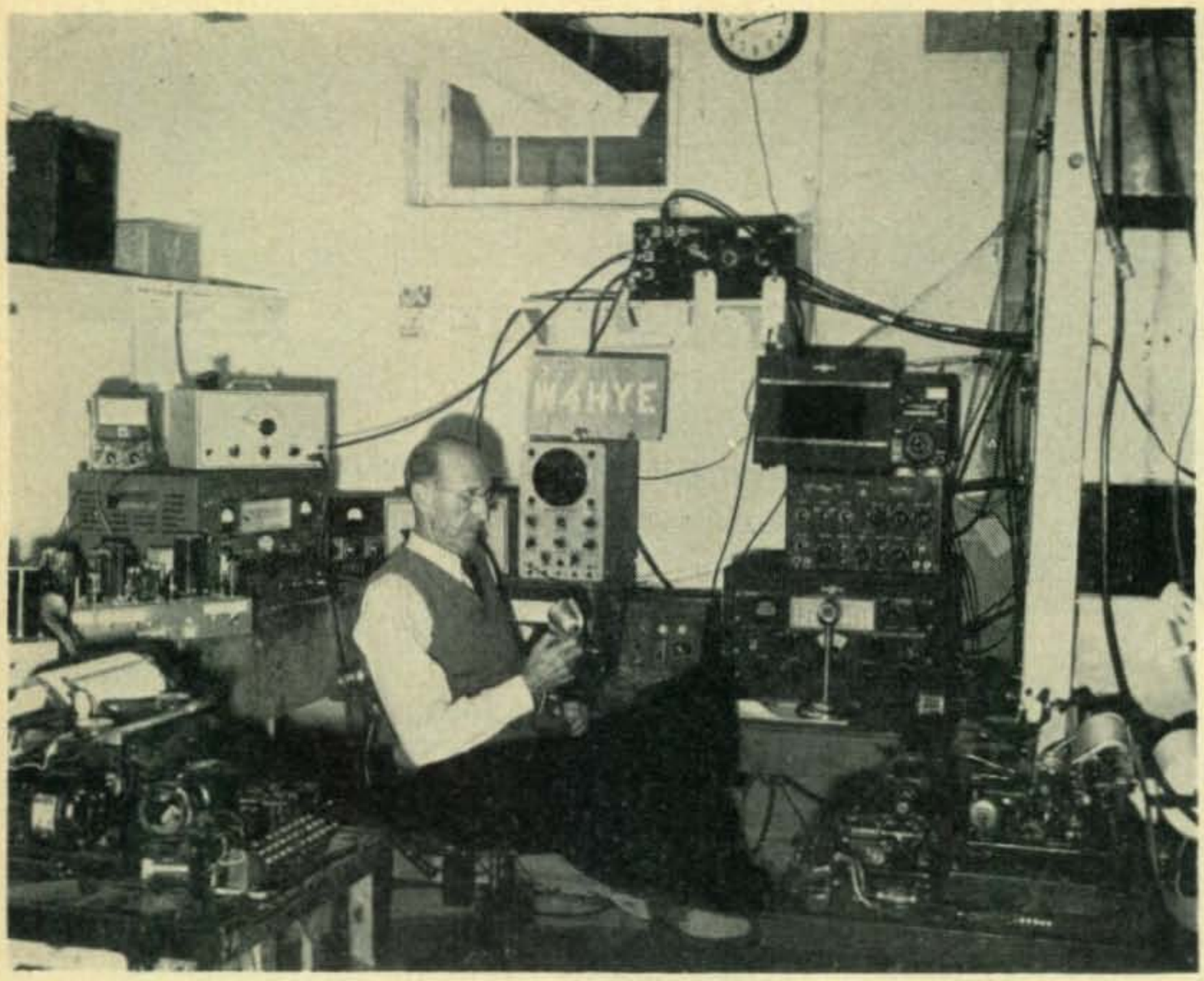
California, AFSK 147,850 kc calling & working

Washington, D. C. AFSK 147,960 kc calling & autostart; 147,495 kc working

Chicago, AFSK (FM) 147,700 kc calling & working

Detroit, AFSK (FM) 147,300 kc calling & working

New York, AFSK (FM) 53,160 kc calling & working; **(AM)** 147,960 kc calling & working



W4HYE, Claytor Lake, Radford, Virginia

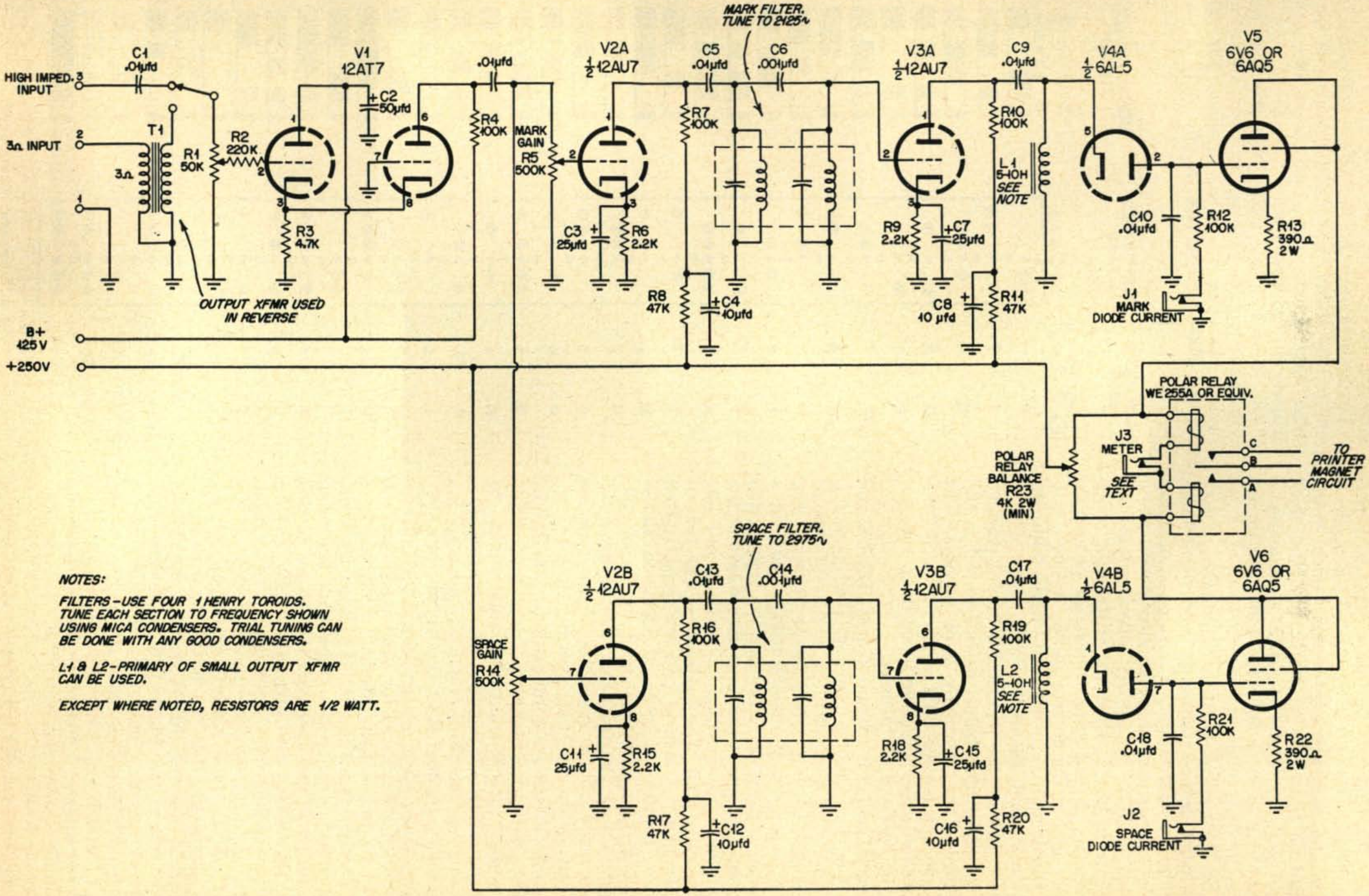
ous types of machines used by amateurs across the nation. But—before getting started, let's see if we can answer the $64,000 question, "Where and how can machines be obtained?" Well, almost all the machines used by amateurs were made by the Teletype Corporation, and were those replaced by the owning system with newer models. Now, *don't* contact your local telephone company or the Teletype Corporation. They cannot, and *must* not, be bothered by individual requests or deals for machines. Those companies that *do* (and they are not too many) dispose of their old machines prefer to do it through established channels. The *RTTY* column in the August 1955 issue of *CQ* listed a few of these channels. If *you* are looking for a machine, your best bet is to go to an active RTTYer in *your* area. He can undoubtedly give you the most up-to-date information on what is available closest to you and from whom. Incidentally, there are a few fellows who rebuild machines from junk; machines badly damaged in shipment, fires, floods, etc. This is how some of the later-model machines get into ham hands. Again, they are not too many. Your local RTTYer will know if such a source is near you.

RTTY Principles & Practice

Part 2—Machines

The Model 12 was the first Teletype machine to be placed in general use by the radio amateur. This venerable old clank is really rugged. Some, after over 30 years of use, continue to pound out copy consistently on the ham bands. It is a "page printer," which means that the receiving mechanism types on a continuous (?) roll of paper 8½ inches wide. Type bars, similar to a typewriter, are utilized. A motor, preferably synchronous, is the source of mechanical printing power. The keyboard, on a separate plug-in base, also contains a motor which drives the receiving and sending distributors. The printer uses *six* electromagnets that require 300 ma. pulses, generated and distributed by the receiving distributor, for proper operation. A *seventh* magnet (start) is used for unlatching the distributor cam. Since all of the magnets receive their current through the distributor contacts and the polar relay contacts, the contacts are a prolific source of clicks and radiated "hash." Shielding all pulsed lines and using R-C filters helps, but does not cure. Little difficulty is experienced with noise when the Model 12 is operated on v.h.f., but operation on 80, 40, 20, or 15 meters requires a rather extensive special treatment involving vacuum tube keyers. (This treatment will be covered in a later P.&P. section devoted entirely to the Model 12.) Consequently, the Model 12 is found mostly on 2 meters.

The Model 14 appears in four varieties; the Sending-Receiving Teletypewriter, the Reperforator, the Typing Reperforator, and the Transmitter-Distributor. The first and third varieties have receiver selecting and typing mechanisms employing type bars to print on paper tape. The first prints on a paper tape ⅜" wide, while the third variety perforates as well as prints on a tape about 11/16" wide. Perforation is simultaneous with printing, but six characters ahead. "Chadless" perforating permits printed and perforated characters to occupy the same part of the tape, as the punchings (chads) are not completely severed from the tape, but form lids attached at the leading



NOTES:

FILTERS – USE FOUR 1 HENRY TOROIDS. TUNE EACH SECTION TO FREQUENCY SHOWN USING MICA CONDENSERS. TRIAL TUNING CAN BE DONE WITH ANY GOOD CONDENSERS.

L1 & L2 – PRIMARY OF SMALL OUTPUT XFMR CAN BE USED.

EXCEPT WHERE NOTED, RESISTORS ARE 1/2 WATT.

Fig. 1. W9LKB Converter.

edges.

The Reperforator perforates standard perforator tape, about 11/16″ wide, via a selecting mechanism which positions punch levers instead of code bars as in the first and third varieties of the Model 14. After positioning, a perforating blow is delivered from a cam on the main shaft of the unit.

The Transmitter-Distributor consists of two main parts; a tape transmitter and a commutator-type of distributor. The tape transmitter "feels" the standard perforator tape, about 11/16″ wide, to set up the code combinations to be transmitted while the distributor sends out the *mark* and *space* signals in proper sequence and at the correct speed. A single self-contained motor is used to drive both the transmitter and distributor.

Very few of the Model 14, of any variety, are found in ham hands as this model is still in current use by many wire services. The Reperforator is good only at the 60-speed (amateur standard), while the other three varieties may be operated at 75-speed.

The Model 15 (Signal Corps TG-7A and TG-7B) is a sending-receiving Teletypewriter. The receiving mechanism is similar to that of the Model 14, but it is a "page printer." The paper is stationary while the type bars, in a carriage, are moved from left to right while printing. Automatic carriage return, when the right edge of the paper is reached, and line feed may be had. The keyboard is like that of the Model 14. The Model 15 is a large, rugged machine capable of 75-speed operation and is still in current production and wide use, consequently few are available to the amateur. Occasionally, rebuilt machines of this type become available, but at a rather high price.

The Model 19 is a combination of the Model 15 page Teletypewriter with a tape perforator-transmitter attached on the same table. As with the Model 15, the 19 is in current production and use, therefore practically none are being used by amateur RTTYers at this time.

The Model 26 is a page-printer type of machine with a keyboard for sending. Unlike the Model 15, but like the Model 12, this machine has a paper carriage that moves as it prints. Also, no typewriter-style type bars are used. Instead, small movable type pallets are carried by a type wheel and are individually hit forward for typing by a hammer or striker arm. So that the completed typing can be more easily observed, the type wheel is made to rise for each character. The keyboard mechanism is similar to that of the Model 14 and Model 15; however, the Model 26 is designed for 60-speed operation only. It is a much smaller and lighter machine than either the Model 12 or Model 15. Like the Model 15, it is a "single-magnet" machine which results in essentially noise-free operation. Its mechanical noise is quite low, too, which is very important from the XYL's point-of-view. (That's why my Model 12 is in the cellar. It woke the baby once!)

Fortunately, for us, the Model 26 is being replaced by many services, therefore this machine has become increasingly available, particularly on the west coast.

The Model 28 is strictly "Cloud 9," as far as hamming goes. This is the latest and most modern Teletype machine, designed for 60, 75, and 100-speed service. If you work a sta-

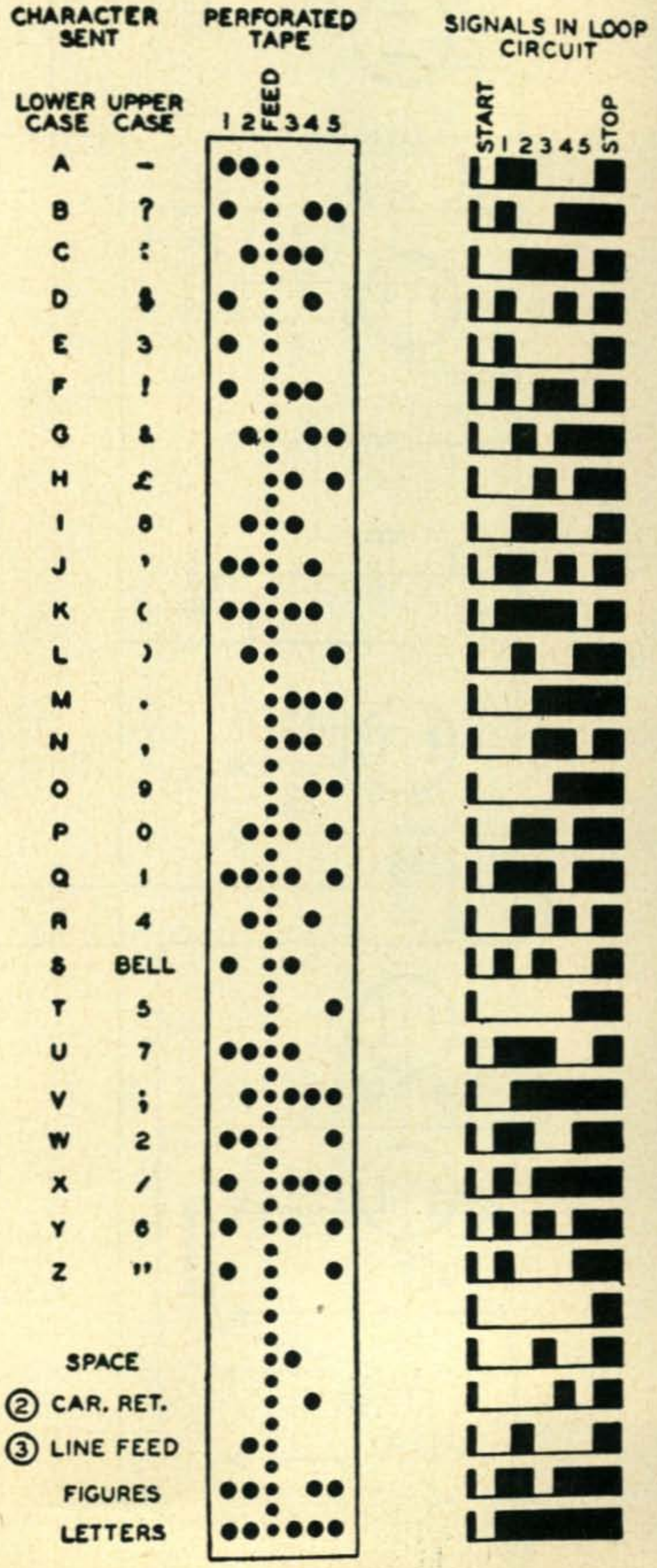


Fig. 2. Teleprinter Signal Code

tion using a Model 28, the fellow undoubtedly is in or doggone close to Chicago!

Tape equipment available, besides that already discussed, are the Model 21A and Model 400 typing units, and the 1A Tape Transmitter. The Model 21A prints on a narrow (about 3/8") tape and is operated entirely by means of solenoids. It is a very compact unit, but does not have a built-in distributor, as it was designed to operate in banks from a single gigantic master distributor. The 400 has its own distributor. However, these are not as plentiful as the 21A. The 1A Tape Transmitter has no distributor, either, but several arrangements for use with the Model 12 keyboard-distributor and the Model 26 make this readily available unit very useful. These arrangements will subsequently be discussed in a later section on tape gear.

Fig. 2 graphically illustrates the signal code used in teleprinter transmission and shows the corresponding perforations in tape. The black portions of chart indicate *mark*, or current in a d-c loop circuit. The smaller holes in the tape are used to engage a sprocket, in tape transmitters, which feeds along the tape from character to character. Five "sensing" pins feel for the holes and whenever one is encountered, a contact is closed, thereby transmitting a *mark* through the associated distributor.

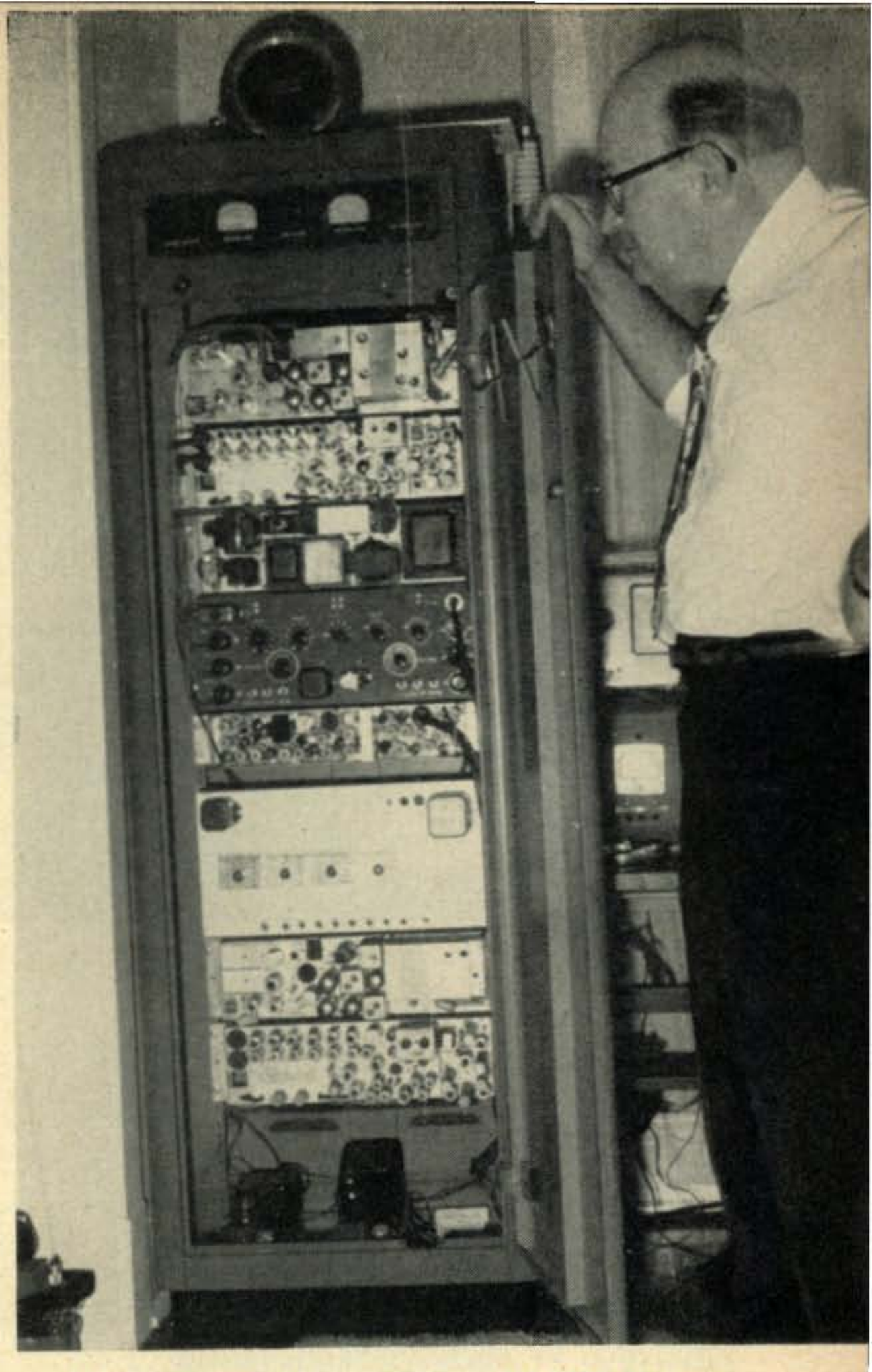
The preceding description of teleprinter machines has been necessarily brief in order to give a general, over-all, picture of the various pieces of equipment that are around. Subsequent parts to your "RTTY Principles & Practice" will describe in more detail those machines in common use by the RTTYers, starting with the Model 12. Photographs, wiring diagrams, hook-up data, and other pertinent information will be included.

Narrow Shift

Our Washington correspondent reports a rather poor job of commenting on DOCKET NO. 11501. Two days prior to the deadline for filing there were a total of six comments filed. What happened? Did the "original and four copies required" scare some of us off? We understand that most of the comments filed were favorable, though, so perhaps by the time this appears in print we will have a change in regulations. For the benefit of those who haven't been following this narrow shift business we suggest that WØBP's article on narrow shift in the December 1955 issue of *CQ* be read.

Across the Nation

The photo of W4HYE shows the Radford, Virginia, radioteletype station of Graham Claytor. With 5 acres for antennas, Graham has a three-wavelength rhombic on 20, a long wire on 75, doublets on 40 and 15, and a 10-over-20 three-element beam. A kilowatt is available for 75, 20, and 10 meters. The 32-V2



Al Witt, W9KLB, Chicago 2-Meter FM RTTY Station

has been modified for FSK. Terminal Units are of the W2PAT and W2BFD type. Graham usually spends the winter in New York City where he operates W2MYL on 2 meter AFSK, with an antenna 16 floors above the street. His son is W4UGO, another RTTYer from Roanoke, Virginia.

W2IRT in Yonkers, New York, says that with so many fellows just getting started in the Westchester area, there is a great need there for an audio frequency standard. He thinks we should publish an article describing how to build a 425 cycle tuning fork standard, like W2JAV's or W2BFD's. (One is in the works now, OM.) A new RTTY station in the Westchester area is K2ERA, the Bronxville (N.Y.) Radio Club. This station is on 2 meters with

[*Continued on page 111*]

RTTY DEMONSTRATION
Chicago Suburban Radio Association
Broadview Village Hall
Broadview, Illinois
Friday Evening, FEB. 3, 1956
W9SPT, W9JBT, W9BGC

Allan Deets, W7WOQ, 2107 Eldridge, Bellingham, Washington. Al takes over control of the T.A.N. one day a week. His station is a Viking Ranger and an SX-71. Al's favorite Band is 40 cw. photo by W7VCB.

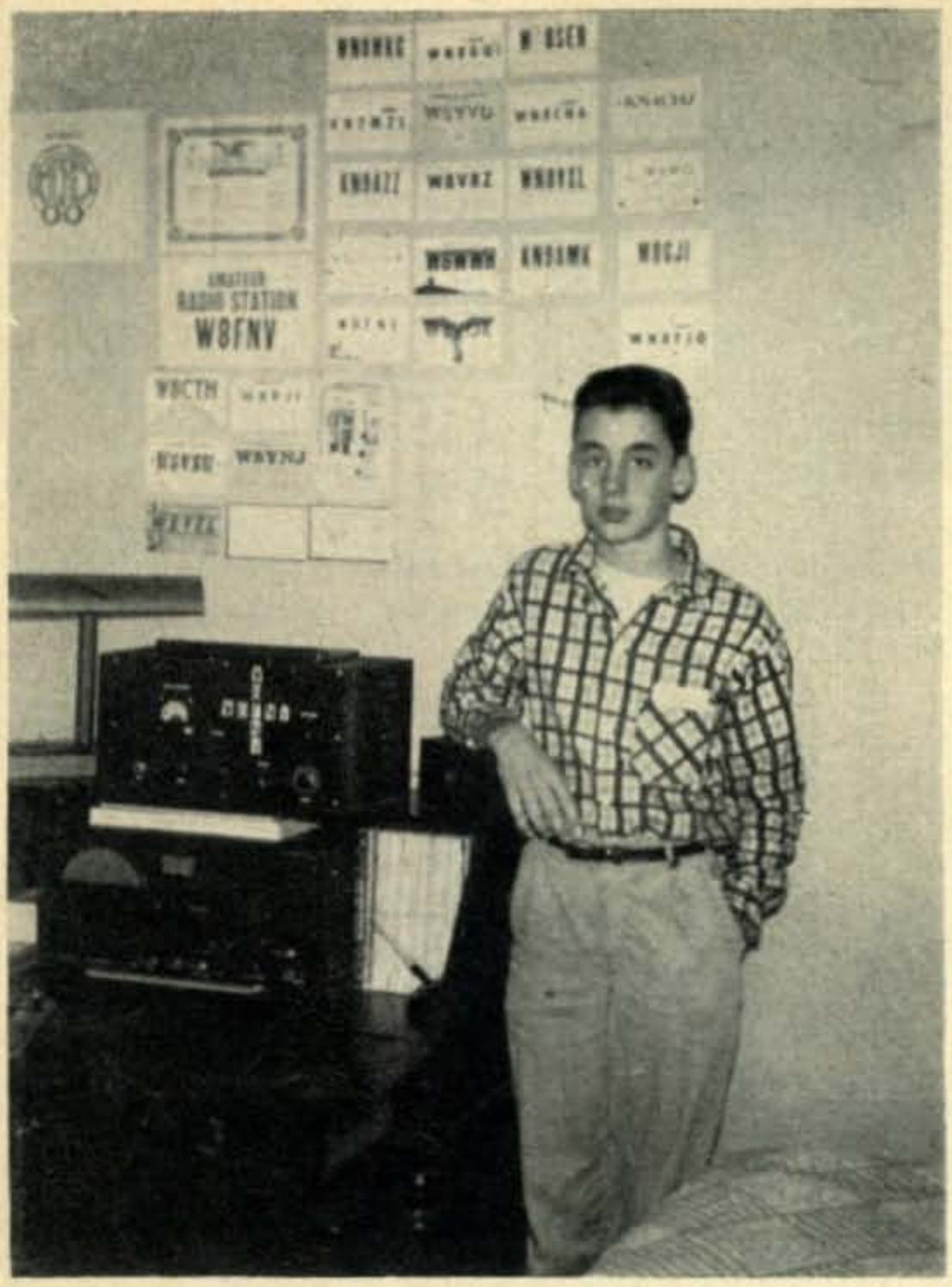
NOVICE

Reported by
Walt Burdine, W8ZCV
RFD 3, Waynesville, Ohio

The cool crisp nights of February are upon us and the long winter nights are becoming shorter. DX is rolling in from all countries, the rig is all set for a nice long ragchew, and most of our good New Year's resolutions are acting as a millstone around our neck. We resolved not to be a DX HOG this year—to give the other guy a helping hand—to follow all the rules of the amateur's code—to at least QSL all cards *received*. Boy, we must have been out of our minds to resolve a thing like that. As Herb, VE6GK, an old friend of mine says, paraphrasing an old adage, "The Road To Waynesville is paved with good intentions", meaning of course that the spirit was willing but the body lacking. This year we can at least do good by helping some ham get his rig performing better or by helping some other person get a ham license, possibly a handicapped person thereby doubling our enjoyment of our wonderful hobby.

I do believe that our hobby is the most enchanting and "equalizing" of all hobbies. Ham radio *can* bring the prince and the pauper together as friends and international friendships *can* prosper as a result of a QSO. We *can* bring a smile to someone's face by handling traffic from a distant relative or friend. We *can* help to save life and property in case of disaster. We *can* further the advance of the electronic art by our experiments and findings. This year we have the opportunity of aiding in communications from all participants of the scientific world that are scattered over the world aiding the **International Geophysical Year** experiments. There are many ways we can help in the following

Ken Buskirk, KN6LIR, 4843 West Avenue 1-4, Quartz Hill, California is shown above. Ken is 16 and a junior in high school. He will sked any on needing California. He has trouble with the QSL business of returns vs. those sent.



Denny Whitney, WN8FNV, Dearborn, Michigan seems to be doing alright with the S-40-B and his homebrew 50-watt transmitter. He is available for Michigan contacts. Denny says he really likes the New CQ.

year to make the public realize the importance of ham radio to our way of life.

We cannot expect the public to understand our importance unless we are important. We can not do that by useless bickering on the air and through the pages of ham publications. Ham radio is a brotherhood . . . let's keep it that way. If you don't like your lot, get busy and improve it—it can be done. Make your transmitter better, improve the keying characteristics, improve your keying as well, put up a more efficient antenna, don't try to modulate 500% unless you can find a way to do it without taking up more than your share of the band. Keep in the band. Check your frequency. Check your modulator to see that you are modulating correctly. Monitor your keying and your modulation. I am working on some simple test equipment which you can afford, that will be built rack-mounted and used to do the job outlined above. These necessary pieces of equipment will appear from time to time in the Novice column.

This year, plan on using the very high frequency bands some of the time*. This will relieve the crowded conditions in the low frequency bands somewhat and help to get occupancy on the higher frequencies. You will appreciate your part of ham radio more by doing this. If the ham population in your state is small, try to operate as many bands as possible. We could use more VHF activity in the Mid-western and Western states. Our findings in this interesting field are helping to understand the ways of propagation in the VHF radio services. This should be a good year for the hams.

*Ed. note: We just received word that VS6DS (Hong Kong) is hearing W1's, W2's, & WØ's on Six!

Nets

Any novice or teen-agers net will be announced in the columns of *Novice Shack*. If you are the *NCS* on a novice or teen-agers net please drop the dope to the editor of *Novice Shack* at the address under *Help Wanted* or that at the top of this column. *Thanks.*

Two new nets recently formed are announced this month. Ken Williams, W4IHB, Auburn, Alabama announces the **AENT** (*Alabama Emergency Net T*). The *AENT* meets on 3910 kc every Monday, Wednesday, and Friday afternoon at 1630 CST: On Saturday at 0800 and a business session on Sunday at 1400. The *AENT* is a teenager's net although anyone with traffic is invited to call in. W4AVX is net manager and any questions should be sent to him. *Thanks, Ken.*

The only active net for the teen-age set in the Northwest is called the **T.A.N.** or *Teen Ager's Net*. It was formed about a year ago to help the beginning amateur to become familiar with net operation and also to handle any traffic to all parts of the United States, its possessions and Canada.

To get on the roll call a prospective member must check in on at least three days of any week. An old member may be eliminated if he fails to check in at least five times a month.

There are now about 40 members scattered throughout Washington, Oregon, Idaho, British Columbia and one member checks in from California. Officers are elected for the period of the school year. The business manager is Lee Wareham, Pt. Angeles, Washington. Mary Klock, W7QWX, Troutdale, Oregon puts out the *T.A.N.* newspaper which sells for 75 cents for the school year.

The *T.A.N.* meets regularly throughout the school year at 1600 Pacific Standard Time Monday through Fridays. The frequency is 3815 kc. We are looking for traffic and anyone is welcome to check in the net at any time. This announcement was sent in by Ken Bale, W7VCB. *Thanks, Ken.*

Meeting of Six-Meter Men

Most of the active six-meter men of Cincinnati, Ohio met at the home of Paul Gunther-Mohr, W8QIS of Kenwood and the main topic of conversation was, of all things, ham radio—mainly Six Meters and the conversation mainly concerned the *BC-1158* surplus transmitter and modulator. A meeting of minds on a subject is a good way to get all of the ideas about the subject, and some good ideas were exchanged on the *BC-1158*. Those attending the meeting

Gene Unfried, W9ITV, McLeansboro, Illinois runs a VF-1, Globe Scout and S-38-B receiver.

were: W8QIS, W8QIN, W8SVU and son W8PCK, W8HQK, W8JSW, W8FXK, W8PLB, W8FTG from the Cincinnati area and W8ZCV and W8INQ and XYL Edith. We really had a good time and Paul and Fran, and two daughters, Ruth and Paula were what I would call perfect hosts. Six-meter activity will be improved by that meeting.

I have received a number of letters asking that the *Novice Shack* ask a couple of questions each month. I am trying to give you what you want to see in this column as long as it is good

Just to show you that Sandy likes ham radio and wants the OM Bill, WN1CWO of Stonington, Connecticut to knock the N out we present the second op WISANDY age 7. Sandy likes two meter phone. Sandy is a technician in the K9 corps I guess. Well dog-gone. Note the phones.

for amateur radio and I think this idea is a good one. (*Any more?*)

A. Can an amateur radio station be operated by anyone that does not hold a license? Anyone can talk into a microphone if the station is operated by a licensed operator. Only those authorized by the *Federal Communications Commission can* operate an amateur radio transmitter, and then only to the extent of the license of the licensee. A ham holding a General Class license cannot operate the station of a Novice except in the Novice bands, with Novice licensee privileges. The holder of a Commercial Class license cannot operate an amateur station, unless he also holds an amateur license.

B. Under what conditions may a Technician Class licensee operate a transmitter without crystal-controlled transmission? A Technician may use **all amateur privileges above 50 Mc except** that he may not operate within the amateur frequency spectrum of **144** to **148** Mc. The Technician can use vfo and he can also run a kilowatt of power if he so desires. He must have accurate means to measure the power input to the final amplifier, as must the General Class ham.

Receiver Preamplifier

Another batch of letters have been asking for an r-f amplifier (preselector) to put ahead of the inexpensive receivers to increase their sensitivity. . . . *here's your answer*. This unit will also increase the signal input of the better receivers. With the 15-meter converter described in the *Novice Shack* for November (coil data in October), and this preselector, signals were received better than ever before at this QTH, using a *BC-946* receiver as the tunable i.f. The converter used a 20-Mc crystal for the oscillator of the converter.

Circuit

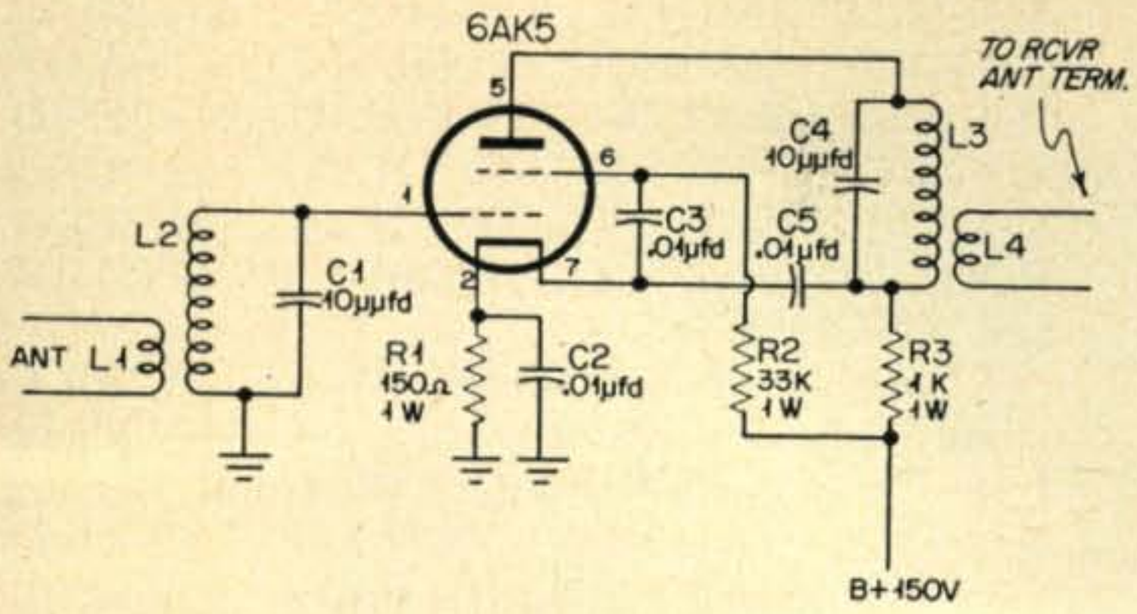
The circuit of the preselector is simplicity in itself and will make a valuable addition to the hamshack of any ham station. The gain of the one tube is plenty to "soup" up any of the smaller receivers used by beginners. Careful and neat wiring will improve the operation of this unit. Most of the parts for this unit are available in the junk-box and it can be built on a chassis, or you can use a *Bud Minibox* (*CU-2103* or *CU-2104*). This will make a neat looking accessory for the hamshack.

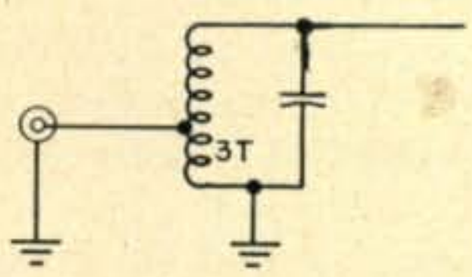
No construction data will be given as the constructor will likely wish to use his own ideas in construction of the unit. Keep all leads short and make neat well-soldered joints. Grid-dip check all coils with the 6AK5 tube in the socket. Tune to about 21.200 Mc and if the pre-amp oscillates, put a shield through the socket across the center post of the seven-pin socket and between pins 4 and 5 (**do not short pin 5**). Make this shield of flashing copper.

The power required is 6.3 volts at 175 ma. and a plate voltage of 150 volts at a maximum

Parts List

C_1, C_4—10 $\mu\mu$fd mica condenser.
C_2, C_3, C_5 — .01 μfd ceramicons
R_1 — 150 ohm 1 watt.
R_2 — 33,000 ohm 1 watt.
R_3 — 1,000 ohm 1 watt.
L_1 — 4 turns insulated hookup wire at ground end of L_2.
L_2 — 16 turns #22 enameled wire close wound.
L_3 — 16 turns #22 enameled wire close wound.
L_4 — 4 turns insulated hookup wire wound on B plus end of coil L_3.
All coil forms are *National XR-50* or available substitutes.





Preamplifier circuit. Alternate input coil below is for coaxial feed line.

of 20 ma. This can be obtained from most receivers or from a small power supply (I prefer the small, separate power supply).

Putting the AT-1 on 6 Meters

After writing the *Novice Shack* for six months, I have found that the transmitter used most by newcomers is the *Heathkit AT-1*. This little transmitter is a complete c-w set, with power supply in a neat cabinet approximately 7x13x8 inches in size. The tubes are a 6AG7 oscillator-multiplier feeding a 6L6 amplifier-doubler, and a 5U4G rectifier.

Bob Simon, W8QLO, of Detroit asked me if I could convert the AT-1 to operate on Six Meters, so I built a prototype and converted it to work on Six Meters before trying the *AT-1*. It worked very well.

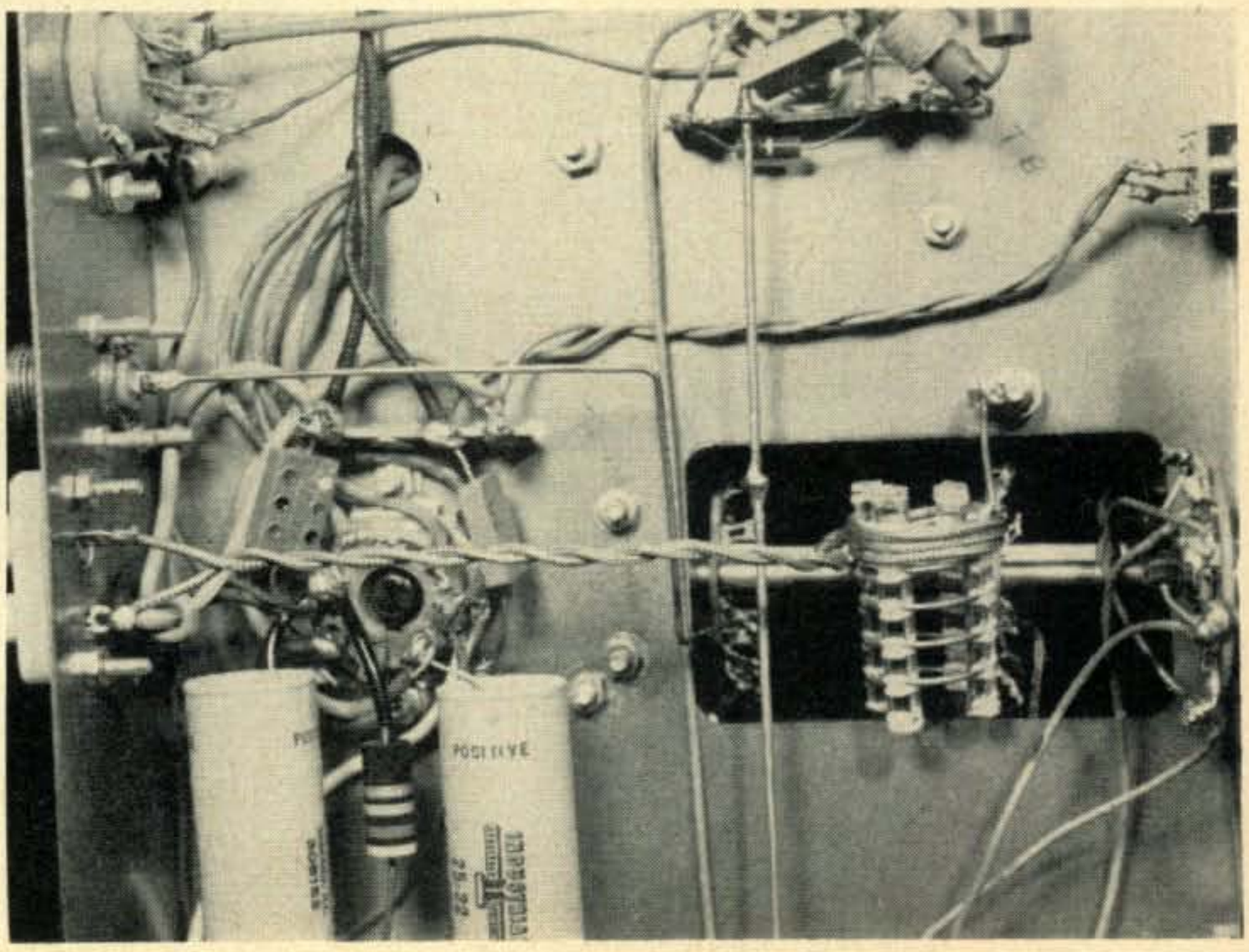
While the power output of the converted *AT-1* will not compete with the kilowatts, it will afford a lot of pleasant contacts on this uncrowded band and it will act as that first transmitter for all the former novices that have graduated to the Technician Class license. The grid drive is enough to permit the *AT-1* to be plate modulated. Next month I will give you the diagram of the modulator used with this conversion.

Converting the AT-1

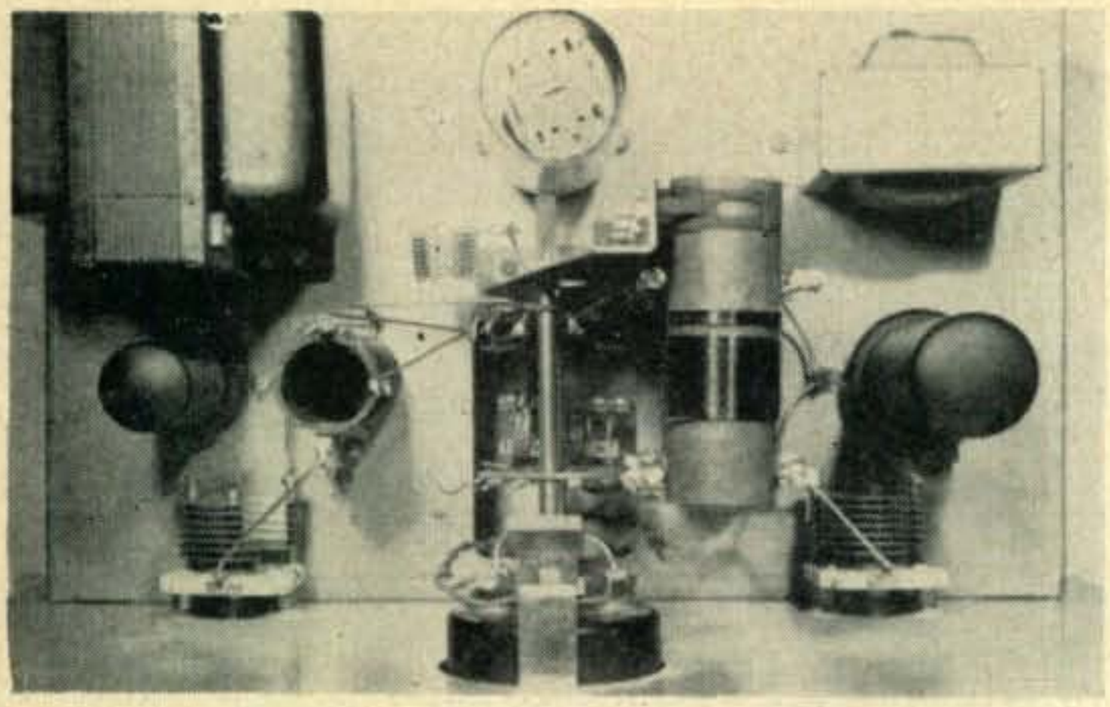
The biggest job of the conversion is acquiring the 5-position switch sections to fit the original switch index. I could not get switch sections to fit the index so I replaced the switch with a 5-position 2-pole (shorting-type) switch. If you wish, you could remove the set of coils for a band you do not use, and replace them with the six-meter coils, thus saving the trouble of acquiring a new switch. With a new bandswitch, switching all bands from 80 Meters to 6 Meters, the output would be from 7 to 11 watts. The *AT-1* doubles on all bands except 80 Meters. The crystal can be 8.35 Mc to 9 Mc, but a little more drive can be obtained by using a 25-Mc crystal, which costs very little more than the 8 Mc crystals.

The only change made in the under-chassis wiring is to change the 47,000 ohm screen dropping resistor to a 2-watt, 22,000 ohm resistor. This will give more grid drive.

A new oscillator coil is made from a piece of *B & W 3006* (or *Air Dux* equivalent). Make this new coil of 7 turns and mount as shown in the picture. Make a new final coil of 4 3/4 turns of *B & W 3009*. Wind a 3-turn link of insulated wire on the ground end of the coil and mount as shown in the picture. Extend the link leads to a crystal socket (or one of your own choice) and mount this socket on the back apron of the chassis. Use this output socket to feed a good 6-meter beam and by that means you can effectively increase the output of the r-f power.



Underside of AT-1 converted for Six. Note mounting of six-meter tank coil and output link.



Top view of converted AT-1. Extra oscillator coil (above, near rectifier tube) and 6-meter tank coil (below switch) are simply connected to extra positions provided by a 5-position bandswitch.

If you should need to buy a new 6L6 tube, you might get a 1614 instead, as it is a special r-f rated 6L6 and appears to work better in the 6L6 socket, though the difference in output is not noticeably greater than with the 6L6.

I sure hope I can work some of the 76 people that went to the trouble of writing me after I mentioned in the November **CQ** converting the *AT-1* to Six Meters. I am taking this way to answer those letters and I'm sure you will forgive me for not answering each letter personally. Thank you for the letters as that is the way that I can tell if you are interested in the VHF bands. Let's get going now and this summer I'll work you on Six!

Letters To The Editor

An air letter arrived from **F. Allan Herridge, G3IDG**, 95 Ramsden Road, Balham, London, S.W.12, England bearing these good tidings for some more of our novices. Here is the letter.

"Dear Walt: I'm a keen follower of your novice columns in **CQ** each month, despite the recent increase in the price of the magazine, hi! Thought you and your readers would like to know how the N's and the KN's have been coming through on the 21 mc band recently.

I'm sure lots of G's don't know about the novices who live in the 21 mc. phone band. Of course, there are the exceptions, who work right up on 21,000 kc and catch the novices who lurk about as low in frequency as they possibly can in the hope of snagging some DX.

I haven't worked any novices as yet, although I've put up a dipole directed on the states. My power is only 10 watts though (as it is on all bands, 160 to 10) and I doubt if QRP would get through the phone. I have two crystals in the novice band—21.217.5 and 21.232.5 kc, and the rig is a 6AG7 CO into a *Mullard QVO4-7*.

Between the 23rd and 30th of October the following novices were logged here on the HRO-MX: KN2MHJ, KN2MUS, KN2OUM, KN4DFR, KN4ECS, KN4EMV, KN9AMT, WN1EGS, WN1FKU, WN1EHQ, WN1END, WN1EVN, WN1GDB, WN1GTO, WN4CEQ, WN9OPD, WN8UKG, WN1FFV, WN1EOA, WN1GZR, KN2ODC, WN3BWU, WN3DJW and KN5BMX/5.

I imagine some of these boys would like to know their signals are getting over to G-land. I hear them working each other and perhaps because no one answers their calls they think their rigs are not getting out to DX.

I will keep trying for WN/KN KSOs whenever the band is open. Best times for G QSOs, I suggest, are as follows:

Mondays to Fridays. . . . Before 1500 GMT: between 1800 and 1900 Saturdays and Sundays. . . . Before 1400 GMT; between 1800 and 1900 GMT.

These times are, generaly speaking, outside of our TV hours and will find many more G's on the air than at other times. G's are licensed for a maximum of 150 watts (cw only for the first year) and we have no novice license over here. I run QRP just for the fun of it and have 24 countries worked since September 1951 when I first came on the air. Best DX all on 10 is W1, W2, HZ, and ZC4 all on cw with an indoor dipole. Have 146 countries heard on 10 since 1945.

I will try and pass the word around via our Ham mags and get the G's to look out for the novices on 21 mc. DX with a maximum of sixty watts shouldn't be too difficult! 73 and the best of luck, Sincerely, Allan.

Editor's note: The maximum power for the novice is 75 watts, Allan and I wish to express my thanks and the thanks of my readers to you for the letter. Good luck to your QRP station. Walt.

From **Bill Turner, WN8EYP,** 111 Carter Street, Beckley, West Virginia. Hi Walt: Glad to see **CQ** enlarge, I think it is worth all of the 50¢. Well the rig here is an *AT-1* and an *S-40-B*. My bets DX is KN6, I have worked all call areas except 7. The states total is now up to 30. I am going for my general in December, as are FCU, ADD, DJW and CUK. How about a novice contest? 73. Bill.

Manuel Greco, (15), **KN2LFG,** 14 West Garfield, Atlantic Highlands, New Jersey writes:

"Dear Walt: I just thought I'd drop you a line to tell you of the activities of KN2LFG. I have been on the air for four months of the ten months I've had my license. I've had nice QSOs with 10 states. For the first three months I used a homebrewed 6L6 one tube rig running 10 watts input. I worked 5 states with this rig on 80 cw. Then my rig broke down and I just couldn't get it going any way at all. About two

[*Continued on page 98*]

PX1EX—ANDORRA

[*Continued from page 55*]

On 7 Mc., it was possible to contact W1, 2, 3 and 9 under somewhat more difficult conditions.

On 3.5 Mc. the only DX that was made was with FA.

Weather conditions were quite variable. We had sunshine, rain, snow, hail, high winds and fog. On the afternoon of the 11th we had to suspend operations in order to secure the tents which were threatening to blow away in the 65 mph gale. During the night of the 12th operators returning to camp were forced to use a compass to find their way through a fog thick enough to spread on bread. On the first night the thermometer went down to 25° F in the tents!

The weather forecast being rather discouraging it was decided to take advantage of a bit of daylight on the 13th and break camp. After a last QSO with F8IJ a QST was sent out at 4 p.m., GMT informing all stations that PX1EX was QRT for 1955.

The equipment was then taken down to the nearby home of Fra-Miquel where a final banquet was organized, presided over by PX1YR who had come to join us.

On the morning of the 14th, after the equipment had been loaded up, the cars formed a column to return across the frontier. It had been a wonderful week spent out in the open air with everyone in the best of spirits and during which the best "ham spirit" never ceased to rule. All of the operators took their turns at the key or microphone and the success of PX1EX was without a doubt based upon the cooperation of each man.

Everyone did their best to make the most QSO's in an effort to satisfy the greatest number of stations possible. Who knows, maybe in 1956 we could do better? All stations who contacted PX1EX can rest assured that they will receive a QSL so they can better their scores in the various contests now going on.

Finally, we want to thank the various official departments with whom we were in contact and whose friendship and understanding contributed to our success.

Equipment Used

A Telerad HF-204 30 watt transmitter with 5763 crystal oscillator and 807 final, modulated by 26L6's, with four crystal frequencies available was powered by 12 volt rotary converter. A ground-plane vertical was used for 14 Mc. with radials at 45′ and fed by 52 ohm coax. On 3.5 and 7 Mc. the vertical and radials were connected together and operated against ground.

The receiver was a 1938 HRO powered by a Mallory Vibrapack and connected to a long wire. A crystal converter was used for 14 Mc. For 144 Mc. a 6J4 converter was fed into the HRO and the antenna was a 4 element yagi beam.

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By special arrangement with C. S. Hammond & Co., world-famous manufacturer of classroom and professional maps, *CQ* can now make available to its readers this 18″ world globe at a fraction of the cost of similar globes.

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CQ-2

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[*from page 96*]

weeks ago I was loaned an *AT-1* and since that I have picked up 5 more states on 40 and 80 meters. I spent three months to get five states and then in two weeks I worked five more states which leads me to believe that high power is the thing, at least a wee bit better than the little 10 watter. The receiver here is an *S-38-C* that I won in a nation-wide contest. Like most novices I have a gripe. Why do the generals get in the novice bands and run 200 or more watts? Shouldn't they run 75 watts like we have to and then we could work them all better? I have nothing against the generals, a general got me interested in ham radio and helped me out, but please remember we use only 75 watts.

The chief interference here is from the television set. It knocks out my receiver to 8 mc. and so far I haven't been able to find a cure for it. I could use some help on that problem.

I am 15 and I have passed my technician license test. I would like to see some technicians on six meters. 73 es DX, Manuel."

Frank Guadiosi, KN2OIL, 7014 Kessel Street, Forest Hills, New York writes:

"Dear Walt: I have been reading the *novice shack* for a long time and thought I would write a letter. The rig here is a *Heath-kit AT-1* running about 30 watts. The receiver is an *SX-99*. My best DX is K6, I have worked 25 states and Ves 2 and 3. I work 80, 40 and 15 meters. I am always kidded about my call, they call me the oily station. I will sked any one needing New York for WAS. 73. . . . Frank."

Pfc. John H. King, KN5BWR/5, Flt. Det. Ninth Fld. Army, Exercise Sagebrush, Fort Polk, Louisiana says:

"Dear Walt: I read with more than casual interest K6DGW's letter in your November column. I think that the generals should stay below 7150 and relieve the crowded situation in the novice bands.

Another pet peeve of mine is the fellow that insists on using a bug, and, in the majority of cases, does a pretty bum job of using it. They should, in my opinion, practice more with their code oscillators instead of fouling things up with their r.f. oscillations. Also, since they are so proficient with their code speed they should spend more time studying their theory and get their general license so they can chew the fat with more speed merchants than they will ever find in the novice bands.

Walt I'm sorry I blew my top, but I had to get it out in the open.

I have a 6L6 running 45 watts and due to moving around I haven't been able to get any concrete results toward getting WAS. My receiving is taken care of with an *AN/GRR-5* and my usual *S-38-D*.

I would like to hear from any other of the gang in "*Sagebrush*" and swap sad "war" stories about life in the field.

Keep up the good work in your column, it gets better every issue. 73. . . . John."

Editor's note: Thanks for the kind words John, and if this column is getting better it is because you readers write and tell me all of the news and ask for your ideas to be printed.

Donald R. Klos, KN9AXO, 543 Hermitage Drive, Deerfield, Illinois writes:

"Hi Walt: I like the way that you are writing the *novice shack*. Keep up the good work.

I have had my ticket 3 months. In this time I have worked 25 states with 18 confirmed.

My age is 14, and I am awaiting the results of the test for the technician license. I will take the general test before long.

The rig here is a *Viking Adventurer*, the receiver is an *S-53-A*. In the antenna line I have a nice variety, a vertical, folded dipole, ground plane and a long wire. That sure is a good way to get fouled up, hi.

I would like to see more on the 220 mc band since I'm interested in vhf. What do you say, Walt?

Ed. note: I said "what do you want"? Be watching, it shall come to pass.

I would like to make skeds with South Carolina, Mississippi, Louisiana, all of the 1s and 7s needing Illinois, I sure need them. 73 fer now. Don."

"Mike" Allen, KN9AGU, 7528 Tripp Street, Skokie, Illinois writes:

"Dear Walt: I'm writing to tell you how helpful and enjoyable the *novice shack* is to me.

I got my ticket last June and I now have worked 41 states, District of Columbia, VE3 and VP9. I operate 40 and 15 meters. Too many novices aren't taking advantage of the wonderful DX band that we have in the 15 meter band.

I am 15 years old and a junior in high school. I am using my dad's (W9JGL) *Viking Ranger* and his *SX-71*. The antenna is a 33-foot vertical that I use on 40 and 15 meters.

I would like skeds with anybody in Maine, Florida, Virginia, South Dakota, Maryland, and Delaware. Thanks and 73. . . . Mike."

Joseph Blinick, (15) **K2KMF**, 151 West 86th Street, New York, 24, New York says:

"Dear Walt: I passed my general last June, but I still am an avid reader of the *novice shack*.

The rig here is a *Viking Ranger* that my

[*Continued on page 106*]

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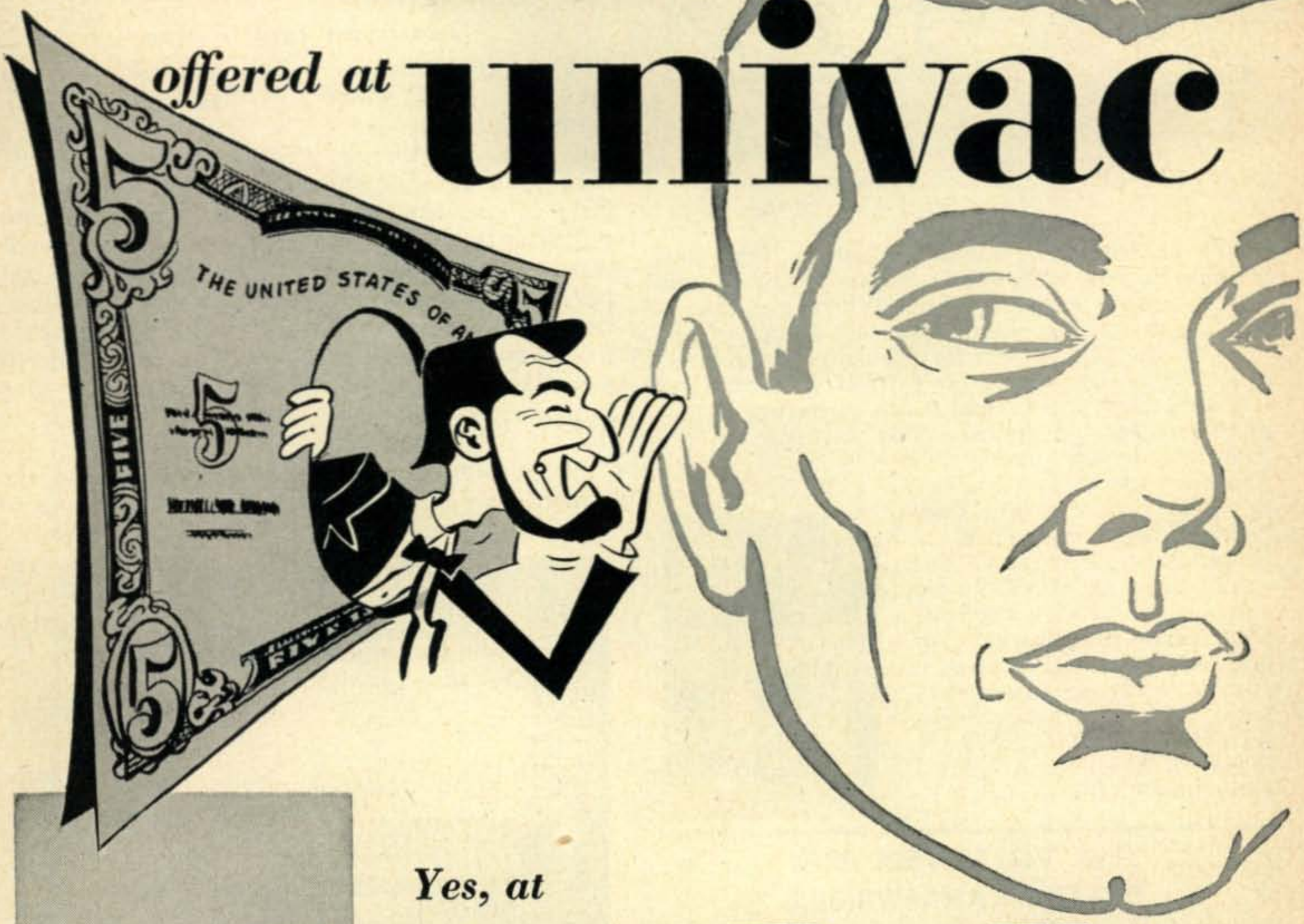

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600W 813's

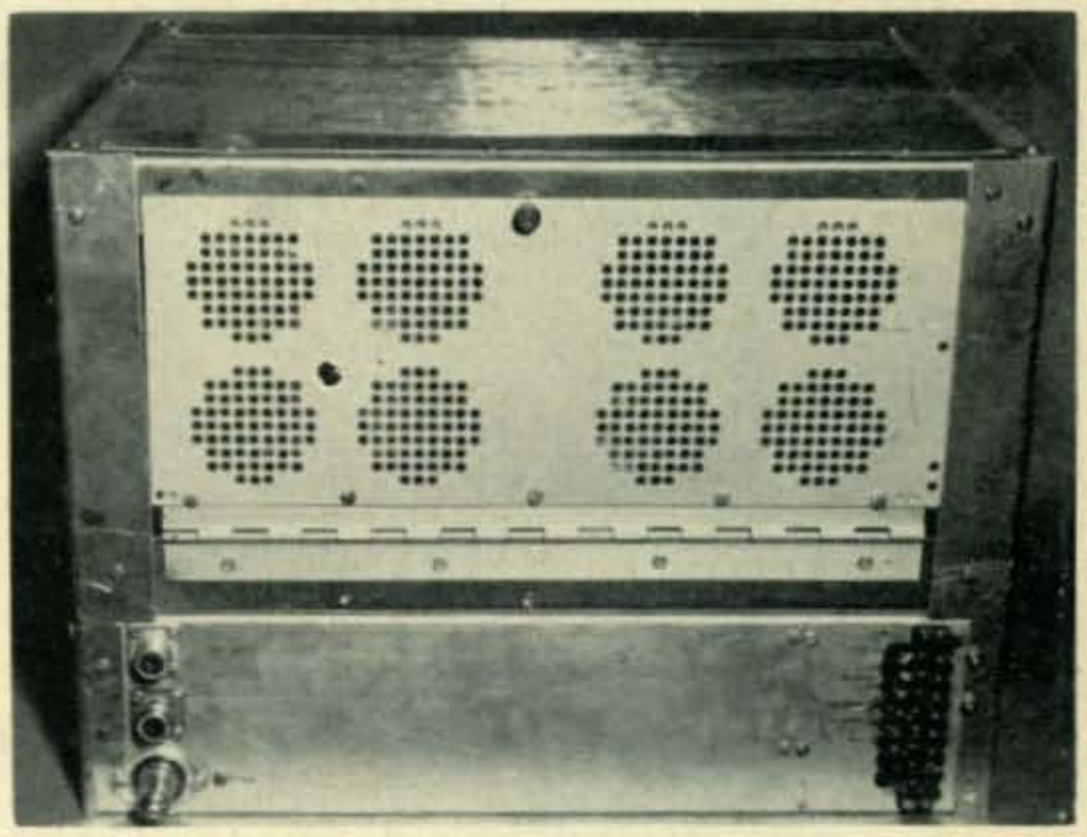
[*from page 25*]

the tube and should be considered when designing the screen supply.

Operation and Tuning

The initial tune-up is straight-forward. After applying the filament and bias voltages sufficient excitation should be applied to cause a flow of about 15 ma. grid current. Excessively high grid current should be avoided, particularly during tuning and neutralizing. The amplifier is then neutralized in the usual manner, starting with the neutralizers at minimum capacity. It is a good idea to check the neutralization for all bands. Attention should also be paid to the symmetry of the neutralizer positions. A large deviation from a symmetrical setting may indicate an unbalance or stray capacitance in the r-f wiring.

Excitation should then be removed and the screen and plate voltages applied at reduced ratings. If the amplifier has no parasitics or



Shielded 813 Xmtr, rear view

self-oscillation no plate or screen current will be indicated. The plate and grid tank condensers should be tuned throughout their respective limits during this check.

The r-f excitation may now be reapplied and the plate tank resonated with the swinging link uncoupled from the tank coil. Plate and screen voltages may now be raised to their normal ratings. After loading the antenna with the swinging link the plate resonance should be rechecked. Any reactance in the antenna or transmission line will probably cause a shift in the resonance setting. *C-21*, in series with the link output, should be adjusted to minimize this phenomena.

Avoid running the amplifier for long periods of time with no load, which will cause overheating of the plate tank coil.

Typical operational readings for phone are:

Grid current	25 ma.
Grid bias	(–175 volts)
Plate voltage	2000
Plate current	300 ma.
Screen grid voltage	350
Screen grid current	80 ma. (for two tubes)

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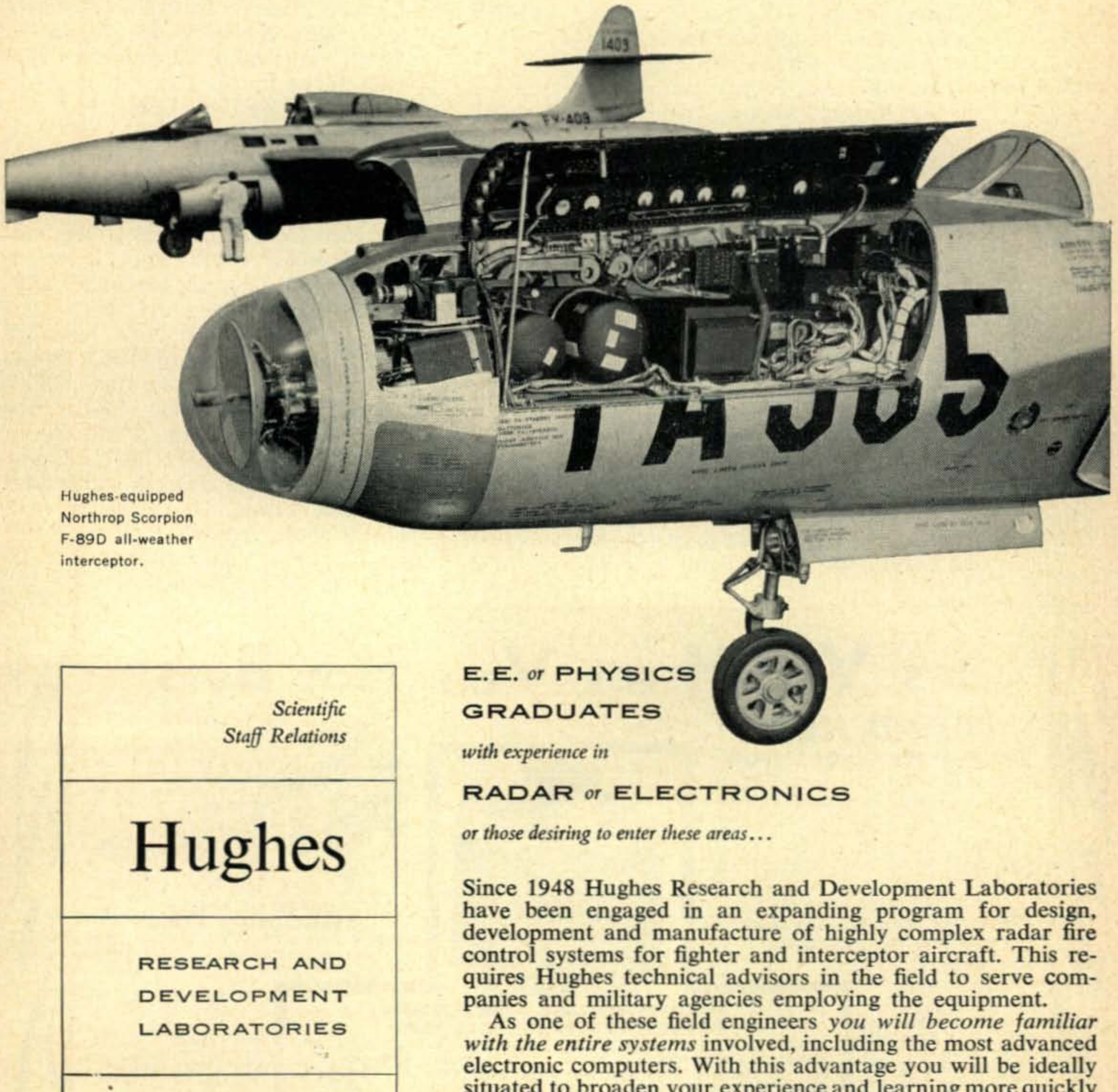

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DX

[*from page 69*]

MP4/VS9, Aden VS9, Iraq YI, Afghanistan YA, Iran EQ/EP, Pakistan (West) AP, ALL UD6, UF6, UG6. Kuwait, Qatar, Bahrien MP4.

ZONE 22—Southern Zone of Asia. India VU, Pakistan (East) AP, Ceylon 4S7, Nepal, Maldive Is., Laccadive Is., Bhutan AC5, French India FN8, Goa CR8, Sikkim AC3.

ZONE 23—Central Zone of Asia. Tibet AC4, Sinkiang Province, Tannu Tuva, China proper—Kansu Province only, Outer Mongolia, Inner Mongolia (except Chahar Province).

ZONE 24—Eastern Zone of Asia. China proper except Kansu Province, Inner Mongolia except Chahar Province, Manchuria, Hong Kong VS6, Formosa C3/BV1, Macao CR9.

ZONE 25—Japanese Zone of Asia. Japan JA, Korea HL, Ryuku Is. KR6, Southern half of Sakhalin Is.

ZONE 26—Southeastern Zone of Asia. Burma XZ, Siam HS, Cambodia FI8/XU, Laos XW, Viet-Nam XV/3W8, Andaman Nicobar Is.

ZONE 27—Philippine Zone. Philippines DU, Guam KG6, Palau KC6, Caroline Is. KC6, Marianas Is. KG6, Bonin and Volcano Islands (Iwo Jima). All islands east of the Philippines west of Long. 163 degrees east. North of Lat. 2 degrees North and south of a line from 163 degrees east, 40 degrees north to 131 degrees east, 23 degrees North.

ZONE 28—Malayan Zone of Asia. Malaya and Singapore VS1/2, Indonesia, British North Borneo ZC5, Brunei VS5, Sarawak VS4, Papua VK9, New Guinea (British and Dutch) VK9/JZØ, Solomon Is. VR4, Port. Timor CR1Ø and all islands between Lat. 2 degrees north and 11 degrees south and west of Long. 163 degrees east.

ZONE 29—Western Zone of Australia. Cocos Islands ZC2, Christmas Island ZC3, Western Australia, Australian Northern Territory.

ZONE 30—Eastern Zone of Australia. Queensland, New South Wales, Victoria, South Australia, Tasmania. All Islands south of Lat. 11 degrees south and west of Long. 163 degrees east.

ZONE 31—Central Pacific Zone. Hawaiian Is. KH6, All VR1, VR3, KB6, KM6, KX6, KW6, KP6, KJ6. All Islands between Lat. 11 degrees south and 40 degrees north and between Long. 163 degrees east and 140 degrees west.

ZONE 32—New Zealand Zone. New Zealand ZL, Tahiti FO8, Fiji VR2, New Hebrides FU8/YJ, Samoa KS6/ZM6, New Caledonia FK8, Pitcairn Is. VR6, Tonga VR5, Cook Is. ZK1, Niue ZK2. All Islands south of Lat. 11 degrees south and between Long. 163 degrees east and 120 degrees west.

[*Continued on page 104*]

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[*from page 102*]

ZONE 33—Northwestern Zone of Africa. French and Spanish Morocco CN8/EA9, Rio de Oro EA9, Ifni EA9, Tunis 3V8, Algeria FA8, Tangier CN2/KT1, Canary Is. EA8, Madeira CT3.

ZONE 34—Northern Zone of Africa. Libya 5A1/2/3/4, Egypt SU, Sudan ST.

ZONE 35—Western Zone of Africa. French West Africa FF8, Nigeria ZD2, Gambia ZD3, Cape Verde Is. CR4, Liberia EL, Port. Guinea CR5, Sierra Leone ZD1, Togoland FD4.

ZONE 36—Equatorial Zone of Africa. Angola CR6, Spanish Guinea EAØ, Cameroons FE8, French Eq. Africa FQ8, Belgian Congo OQ5, Ruanda Urundi OQØ, Northern Rhodesia VQ2, St. Helena ZD7, Ascension Is. ZD8, Sao Tome and Principe CR5.

ZONE 37—Eastern Zone of Africa. Mozambique CR7, Kenya VQ4, Uganda VQ5, Tanganyika VQ3, Nyasaland ZD6, Ethiopia ET3, Somaliland I5/MD4, FL8, VQ6, Eritrea ET2, Zanzibar VQ1, Socotra Is.

ZONE 38—Southern Zone of Africa. Union of South Africa ZS, Southern Rhodesia ZE, Swaziland ZS7, Basutoland ZS8, British Southwest Africa ZS3, Bechuanaland ZS9, Tristan da Cunha and Gough ZD9, Bouvet Is.

ZONE 39—Madagascar Zone. Madagascar FB8, Reunion Is. FR7, Seychelles VQ9, Mauritius VQ8, Aldabra Is. VQ7, Chagos Is. VQ8C, Comoro Is. FB8, Marion Island ZS2, Heard Island VK1, Kerguelen Is. FB8.

ZONE 40—North Atlantic Zone. Greenland OX/KG1, Iceland TF, Spitzbergen, Franz Josef Land, Jan Mayen Island.

Honor Roll Endorsements

(To December 15th, 1955)

W1FH	40-265	KV4AA	39-250	W9FNR	38-175
W6VFR	40-261	W2QHH	39-233	W5FXN	37-190
W6SYG	40-257	W1HX	39-231	W3WU	37-173
W6AOA	40-256	W9HUZ	39-231	W9WCE	37-166
W8PQQ	40-255	W8UAS	39-224	WØANF	36-176
W6MEK	40-254	W2HZY	39-223	K2BZT	36-163
W6SN	40-253	W3KDP	39-218	W1JDE	36-158
ZL2GX	40-251	W6DI	39-216	W6WWW	36-108
W6ADP	40-248	W3DKT	39-216	K2GMO	35-162
W3JNN	40-246	W8KPL	39-200	W6ZZ	35-146
W6EBG	40-245	W2GVZ	39-198	ZL3CP	35-128
W5KC	40-236	W1KFV	39-194	W2HAZ	35-116
VK2ACX	40-233	OE3WB	39-193		
W6TI	40-230	W6TXL	39-185	PHONE ONLY	
W6NTR	40-218	WØQVZ	39-180		
W6LN	40-207	K2GFQ	39-172	W6DI	39-215
W7ENW	40-193	W9ALI	39-151	W6VFR	39-188
W6PH	40-173	W5KUJ	38-200	W6AM	38-192
W6ID	40-168	W4EPA	38-182	W3JNN	37-214

Last complete HONOR ROLL appeared in the January issue. Next complete HONOR ROLL will appear in the May issue.

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(See Page 121 for subscription blank)

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PROPAGATION

[*from page 74*]

upon the observation of the *effects* of the disturbance, rather than the cause, because the physical processes involved in the development of a radio storm are not yet fully understood. A great deal of work remains to be done, and is in fact being done, to improve the reliability of ionospheric disturbance forecasts.

No doubt readers have already noticed a similarity between radio storm forecasting techniques and those used for weather reports. The similarity ends here as there is no evidence to indicate any association between ionospheric disturbances and meteorological or weather storms. The ionospheric disturbance is however directly associated with other phenomena observed on the earth. For example these storms are almost always accompanied by violent fluctuations in the magentic field surrounding the earth, and with visible aurora displays in the high latitudes of the earth. Magnetic storms and aurora, as well as their influence upon shortwave radio communications will be discussed subsequently in this column.

LETTERS

[*from page 51*]

Dear Wayne:

The 'never say die' on the editorial page brings up the topic of amateur phonetics. This is a subject which has always interested me, and I have promised myself to make a list, but so far such a project remains in the future. A few that come to mind, however are W8 Standing-Room-Only; our club station, W8 Queer-Martian-Zebra; and my own, William's Eight Slightly Underfed Brothers. Nearly every ham has a phonetic, so I wonder what the gang has to say on the subject?

John, W8SUB
Parma, Ohio

Sirs:

I would like to point out something which is not perhaps noticed by too many hams. This is the practice of a ham saying "100% QSL, TRY US" or "We QSL 100%, SEND YOUR CARD AND SEE!" and even "ALL QSL's ANSWERED."

It is a mathematical certainty that someone has to send the first QSL after any given QSO. If we all sat back and waited for the other fellow's card, there would be no QSL's whatsoever. To me, the attitude of waiting for the other card to arrive first is not the spirit of ham radio. I have been an active ham since June 1937 and still enjoy very much sending and receiving QSL's.

Based on over 500 post-war QSO's and approximately 99% QSL's, here is the return percentage:

W1	54%	W7	82%
W2	66%	W8	48%
W3	48%	W9	64%
W4	65%	WØ	57%
W5	78%	DX	51%
W6	74%		

John E. Maddox, W4TAJ
Montreat, N. C.

NOVICE

[*from page 98*]

father gave me for my birthday in July. The receiver is an *SX-96*. The antennas are dipoles for 40 and 20 meters. With this rig I have worked 42 states 22 of which were worked as a novice, best DX so far has been Germany.

I call CQ WN just off the low end of the

novice 40 meter band every so often and I'm surprised at the number of contacts I get from novices that say I'm their first K2. Well that's about all for now, good luck to you and your fine column. 73. . . . Joe."

Tom Gallagher (13) 5797 Southwest 60th Street, South Miami, Florida. His call is **K4DRO/KN4DRO** and he writes:

"Dear Walt: I have had my license six months and have been active for four months. I have had my technician license for about a month, and I plan to take the general test during the Christmas holidays.

I have worked 24 states on 40 and 15 meters, I operate only on 15 meters now. My rig is a *Hart-75* running a novice gallon. The receiver is an *S-85*.

I would like to sked any KN6, WN7, KNØ, W1, Delaware, South Carolina stations needing Florida. I will QSL 100%. The frequency here is 21.129 mc. 73. . . . Tom."

Charles Rademacher (13) **WN8EMN**, 20201 Grandville, Detroit 19, Michigan writes:

"Dear Walt: I have been on the air for about two months now and worked about 14 states. The reason I am not too sure about my states total is because some of the KN5s and KNØs that I have worked did not give me their QTH. I would appreciate it very much if you could give me their QTH. The calls are KN5BGT, KN5CRC, KNØBJL, KNØBNA and KNØCFE.

I am 13 years old and my rig is an *SX-99* and a *Hart-25* running about 9 watts output.

I enjoy reading the *letters to the editor* very much, Keep up the good work. Sincerely Yours, Charles."

George Poynor, **K5AZN**, Route #2, Box 107-J, Hammond, Louisiana writes,

"Dear Walt We're off and running here in lazy, lovely Louisiana and the ham situation is beginning to perk up. In a town of 12,000, we now have 14 hams. We're working on some scheme to create interest, such as exhibiting equipment, or human antennas, but haven't got any good ideas yet. Any donations will be welcomed.

I passed my novice exam in May and my general in August. In a couple of years I'll take a crack at the EXTRA. I am 17, and a pre-engineering student at *Southeastern Louisiana College*. Two of the faculty members are hams and we have a *Viking II* and an *SP-400* in the club shack. I passed my brother on his novice exam about three weeks ago and we are waiting for his ticket now.

The rig here is a 6146 with about 7 watts output and an *AR-2*, a Windom 45 feet high radiates. I've had this set-up about three weeks but not a single contact. Would like to hear from anyone having trouble or just wanting a ragchew. We hope to organize a club soon and could use some info on that.

[*Continued on next page*]

[*from preceding page*]

Here is a partial list of our ham population: KN5s ACK, BHV, CAV, CIT, and my younger brother who hasn't a call. W5s VAR, NPJ, SPI, TRS and YIM. K5s AER, APF, AZN, AZU. 73, Walt and good DX, George."

Judy Ward, **KN5CEN**, 1617 Ballinger, Abilene, Texas, writes this nice letter.

"Dear Walt: I was pleasantly surprised by the announcement of a novice net in the November issue of *CQ*. I dropped the boys a line offering my services.

I am a novice YL since the last part of August. My call is KN5CEN. I will schedule anyone needing a YL QSL from Texas.

I would like to see an article on net procedure in the *novice shack* real soon!!!!

I have a lot of questions such as follows: A. How fast should your code speed be before joining a net? B. How does a net control operate? C. Do you think a net run by novices would be practical and efficient? D. Are there any novice nets in operation now which I might join? 73. Judy."

Editor's note: I have announced a few novice nets in this column before and there is an announcement in the forepart of the column this month. Any one that can help Judy out as to the nets operating in the south please get in touch wtih her. The code speed is governed by the slowest member in the net and the novice net should operate at speeds ranging from 5 to 15 words per minute. I suggest that you tune around the bands and locate the nets now in operation and get their procedure and times of operation, this will help your code speed.

Nebraska comes through with a letter from a husband and wife team. They are, **George (WØZVY)** and **Louise (KØAQV) Carson**, 717½ Main Street, Pella, Iowa. They write:

"Dear Walt: I read your column about every time I get a chance, so want to take this time to drop you a line to tell you of my good luck that I have had as a ham.

I have worked 46 states, just need New Hampshire and Mississippi then I'll have all of them. I have even worked some dx, SM-5, G, PY-1, KV-4, VP-5, KH-6, WH-6, VK-7, and ZL-2, the last three was on 40 cw and the rest on 15.

My rig is home-brewed, 70 watts into a 350-foot long-wire antenna for 40 meters and a rotary dipole for 15 meters. I have just put up a cubical quad for 15 meters but have only had 2 QSOs so far. The receiver is a *Collins 75-A-1* with a mechanical filter sand it sure does a good job for me. 73, George and Louise."

Peter Zimmerman, **W5ECG**, (14), 7702 Pennsylvania Place N.E., Albuquerque, New Mexico writes:

"Dear Walt: I have had my conditional for al-

most a year now but I still read the *'Novice Shack.'* Why? I am still a novice at heart and like to hear what the boys are doing.

I am sure I have the worst novice record: 4 states and 8 contacts as a novice. It took me eight months to amass that record. My record has picked up a bit, 29 states and VE-3, 6, and 7. Of course I'll schedule anyone needing New Mexico for any reason.

As you may have guessed I have another reason for writing this letter. I am trying to get in touch with any hams in Northwest New Mexico and Northeast Arizona. I am a volunteer in the *Ground Observer Corps.* At the filter center here in Albuquerque we have a complete ham station. It was set up with the idea of getting some of the hams in those regions to man spotter posts in case of emergency and to radio in reports to the filter center. We hope to get it operating on two meter phone an dwe will include novices in our set-up. This will be a vital link in our air defense set up as there are no telephone lines in that area. I hope you can mention this in your column as all novices read *novice shack.*

Any ham interested can write me at 7702 Pa., Pl., N.E. Albquerque, New Mexico. Very truly yours, Peter."

Dennis Schultz, KN2O?U, 185 Park Avenue, Passaic, New Jersey writes:

"Dear Walt: I've had my ticket for about two months and a half and in that time I have about 20 states on 40 meters. My rig consists of a *Heath-kit AT-1* transmitter, an S-85 receiver and an off-center fed *Hertz* antenna. I would like to sked someone in Delaware. I operate mostly before I go to school. How about a QSL of the month? 73. Dennis."

Editor's note: Novice QSLs may be entered in the regular QSL of the month contest, Dennis. Have you entered yours, Why not? Don't think that the novice QSL won't be given as much consideration as any of QSL. Try it.

Chas. Morenus, KV4BK, P.O. Box 618, Christiansted, St. Croix, U.S. Virgin Islands writes:

"Dear Walt: I believe that I have worked everyone who read my letters to the shack in the March and July 1955 issues and there are no others who listen outside the band so I'd better drop you a line.

Some time ago a local noise condition came on that prevents me from working 7.1 mc at the time mentioned but I'm on almost every morning somewhere between 4 and 5 AM local time until 6 AM (0800-0900 to 1000 GMT), midnight to 2 AM PST, 3 to 5 AM EST. I call CQ WN on about 7140 or 7145 kc, so if some of the fellows I hear calling CQ DX (where do they listen for DX, in the middle of the WN-KN QRM?) will listen outside the band they will probably hear me but they shouldn't become discouraged if they don't hear me the first time they listen. I get on at irregular times

[*Continued on next page*]

[*from preceding page*]

depending on when I wake up and some mornings local noise conditions are such that any QSO even with powerful locals is impossible, so I don't even call CQ. Anyone who expects to be a DX man will have to cultivate the habit of being patient and doing a lot of listening. When I hear a DX station I want, I keep a close watch on the frequency I heard him on so that when he shows up again I'm ready for him.

One other thing they should learn is to keep the QSO short when working DX, usually there are a number of others waiting and an R.S.T. QTH and name is enough. Telling the DX station he is your first QSO from that country, asking him to QSL and giving him your complete address is just a waste of time, yours and his. He will get the address from the QSL, send yours first. Personally, I QSL 100% for all cards received (when log confirms the QSO) but no others, 73. Chas."

Time Hangs Heavy For Injured Boy, 9

I am wondering if one of your readers may be able to help us with a problem?

Our 9-year-old son "Ricky" was struck down by a 16-year-old on our county road last August. He has been in a body cast since then and now we have been informed that he must remain that way until after the first of the year because of the extent of his injuries.

We have run out of ways to occupy and amuse his long days. Because of the body cast he is limited as to what he can do.

We hope some of your readers may have some ideas that may help us out. His recovery will be long as he has to have the same type of therapy as a polio patient and learn to walk all over again.

He also likes to receive mail.

R. LUCAS.
R. R. 2 Box 61
Prairie View, Ill.

Walt Burdine, W8ZCV
RFD 2
Waynesville, Ohio.
Dear Sir:

Attached is a clipping from the Chicago Daily News. I described ham radio and SWLing in a letter I sent to him and enclosed my QSL. I wonder if you could publish this in the novice column and suggest that anybody who cares to drop a QSL to the boy.

73,
Len Petraitis, W9IKW

Help Wanted

Irene McWhorter, Route 3, Benedict Road, **Cedartown, Georgia**. Irene needs help in getting started as a ham and she needs some ham to advise her in procedure.

William Loucke, (23) 131 West Central, **Greensburg, Indiana** needs help in code and theory. William would like some foreign pen-pals.

Thomas Oda Miller, Post Office Box 411, **Bucklin, Missouri** wants some help with the code, he knows the theory.

Robert Oconnor, 4816 Browning Road, **Merchantville, New Jersey** needs some help in code and theory.

John J. Voigt, *S/S Esso Everett, Esso Shipping Company Agent*, 156 Williams Street, **New York 38, New York.** Or **Sheboygan, Wisconsin**. John has just passed his novice test and wants some help in studying for the general. He will be maritime mobile.

Ralph McMillan, Jr., 62 Church Street, **Owego, New York** wants a ham to give him his novice test, he is 17 and is anxious to get in on the fun.

Mark Wm. Dubin (13), 96 Westminster Avenue, **Bergenfield, New Jersey**, Telephone: DUS 4596 needs help in code and theory.

Charles E Hanley, 2625 35th Avenue, **San Francisco, California**, wants some one to help him with the code and theory and to help get some ideas as to equipment needed to get going.

Sammy Schad (15) 124 Walnut Street, **Binghamton, New York**, Telephone: 3-1366. Sammy wants help in code and theory and some ideas as to how to lay out a station.

Garrett B. Edgar, 20 Filbert Street, **Forty Fort, Pennsylvania.** Telephone: BUtler 8-4031 or BUtler 7-6696, or Room 207, YMCA, Williamsport. Pennsylvania needs help in code and theory for the novice test. He is at the *Technical Institute of Williamsport*. Pa.

Stanley Zacharyasz, 378 Eastland Road, Berea, Ohio wants help in code and theory. His brother is W8RKX of Dayton, Ohio.

S/Sgt. Bill Brown, U.S.A.F., 322 Pacific Street, **Monterey, California** or Box 1436 ALS Presidio of Monterey, California. Bill needs help in code, he has enough theory for the novice ticket.

Each month CQ lists the names of those requesting help in obtaining an amateur license. To have your request listed send your name, address, and all particulars to Walter Burdine, W8ZCV, R.F.D. #3, Waynesville, Ohio.

Your request should be in my hands by the 14th of the month and will appear two months later. Thank you. 73 ES CUL.

Walt.

RTTY

[*from page 91*]

Kern, W2GHH, doing most of the operating K2ERA is on autostart, on the hour, 24 hours a day. (No baby to wake!)

KH6ZD has his Model 26, now, and is busy completing a W2PAT Terminal Unit. He modified his 32-V2 a-la-WØJRQ with the help of KH6AED, the SCM for Hawaii, who will also be on RTTY soon. Sam, KH6AED, is looking for a transmitter-distributor, by the way. Another newcomer in hula-hula land is Henry, KH6LD. He will soon have a Model 26, and he is already set with a W2PAT TU, a Viking, an HQ-129X, and an SCR-522 for 2 meters.

W5FPA, Dave Walker, in Van Buren, Arkansas, would like to get on FSK with his KW. He says that nobody is on 2 meters in his area. *How about that, Sam?* W5DWN, Jay

[*from preceding page*]

Sewell, of Belton, Texas has a strip printer and is looking for a keyboard to go with it. The Model 12 keyboard, with its distributors, and the Model 21 make a good combination, Jay.

W8TCT, Bill Kriz, in Cleveland, now has a Model 12 and is building up the W2PAT TU to go with it. For the information of those of you who have written asking for dope on this very popular TU it appeared in the January 1953 issue of *QST*.

W6ZBJ, Cecil Crafts, is working on a discriminator-type of converter for narrow shift. He is also working on a mobile rig for his Volkswagen. Is it a Kombi or Micro Bus, Cecil?

W4WMU, of Miami Beach, Florida would like to put his Viking Ranger (which drives a KW) on RTTY. Has anyone got any dope on FSKing the Ranger VFO? If anyone has, please send me the dope so that you can let the rest of the Ranger owners in on it via *CQ*.

Harold Wade, W7HRC, is working in Chicago and living in Oak Park until about May. He was recently invited to appear before a combined radio club meeting at Downers Grove to give an informal talk on RTTY, giving the basic points and telling how to get started. It appears that the DuPage County boys are quite interested in RTTY.

40 Meters

Since the initial comment appeared in the December *RTTY* column about changing the national RTTY frequency from 7140 kc to another frequency to try and dodge some of the broadcast and commercial QRM, your RTTY department has received a flood of letters, particularly from the novice group. The RTTYers on the west coast are not bothered too much by the "junk" that raises hob with 40 meter QSO's of phone and CW as well as RTTY all along the east coast and into the midwest. Novices are a bit disturbed at our suggestion to use 7150. For example WN7BSP in Tucson, Arizona, says he is a DX-minded novice. Stuart has heard ten countries and has worked three just below 7150. "Would I have heard them through RTTY interference or down lower in the band. . . .?" he asks. W2BDI and W2JAV favor 7105 kc and have successfully operated that frequency with only slight QRM from a foreign commercial (RTTY) a bit lower in frequency. Any other suggestions?

80 Meters

RTTY activity on 80 meters is really at a high peak this winter. Many of the east coast gang have left 40 for 80, temporarily, because of the "junk" around 7140 kc. Even Amos, W5JBW, has come up on 80. W2BDI has a full gallon there, and can play "bells" with anyone. W2PBG also has a KW now, and recently worked W6AEE about eleven p.m. (EST) one evening. He has also worked VE7KX on Lulu Island, British Columbia. Other stations that

Bob has worked lately on 80 are W9BGC, WØBP, WØFQW, W8EMO, and W8LEX.

Comments

To add a personal note, W2JTP is now the proud possessor of a Model 26. It's so pretty (and quiet) that the XYL lets me keep it in the *living* room!

Let's hear from you fellows following the "RTTY Principles & Practice" section. If you have a particular question regarding what has or has not been covered, don't hesitate dropping me a line. You old-timers; if you have a suggestion or two about what should appear in this section, shoot it along. It will be well appreciated.

VHF

[*from page 86*]

Columbia, Missouri (WØBKV), south to Dallas and Ft. Worth, Texas (W5AJG, W5CVW, W5UND and others). I'd sure like to work some Arkansas stations, but so far, no luck."

You had me worried for a minute there Sparky, a Tulsa to Buffalo contact and I had never even heard it mentioned. But then we easterners only know of one Buffalo.

Alhambra, California: Corky (W6ORS) has been most encouraging and volunteers this information:

"This station runs a measly hundred and eighty watts.

Measly, huh!

"(4-64A) to twenty-four elements Vertically polarized.

Only he capitalized the entire word.

"In 'Loupin the loop' (a column in the publication West Coast Ham Ads) much 220 Mc. info on station activity is reported. This band, I feel, *and I do too* is one of the most neglected bands allowed the amateur operator of today. More and more fellas are showing up on this band and getting back into the 'do it yourself' spirit because of the short supply of commercial gear. This operator runs nine watts input to a 12AT7 to sixteen elements at twenty feet, and have worked most of the fellas on the band here in southern California. A crystal controlled converter completes the station, and is, incidentally, home brew. (6BK7A-RF, 6J6-double mixer, 6J6-oscillator, 6CB6-IF)."

Happy to hear of the increased activity on Two-twenty in southern California, Corky. Seems like the New England VHF men are also beginning to activate that band here.

Chicago, Illinois: A portion of the letter from WN9OKB, who was portable on Mt. Washington in New Hampshire:

"I certainly enjoyed the many contacts that I made from the mountain though sorry that I didn't have the chance to talk to you over the air.

"I made an interesting two-meter contact on the way back to Chicago from Boston. I made

the trip on the New York Central train, the 'New England States.' While the train was stopped in Schenectady, New York, I plugged my Gonset into the shaving outlet, extended the Whip, set it up on a suitcase and tuned the band. I heard W2VDI calling CQ and gave him a call. He came back just as the train started to move and I explained to him where I was. He followed the train with his beam and we had a fine 'railroad mobile' contact at seventy miles per hour. This was from an all metal grounded railroad car. Thought it was quite unique.

"Enjoy reading the column and especially the photos of the gigantic antennas. I'm putting up twelve rotated elements at forty-five feet this week."

Quite a contact, Ken, funny where a fellow can pick up a contact.

Endicott, New York: Some more contest suggestions from Bob (W2YLM):

"The gang from the southern part of New York would suggest that the scoring method used should encourage both single and multiple operator participation through separate listing and awards.

"About schedules: I wonder if you or the XYL would be open for skeds on Six Meters on Friday evenings.

I am, Bob, any time any day.—W1HOY.

"We now have a six-element beam and crystal controlled converter. We are working on an 829B final."

YL

[*from page 86*]

a net, which resulted in the present net/club. Its second anniversary luncheon is scheduled to be held in Houston next year.

SK

It is with heavy heart we must pass on the news, received from W5SYL, Iva, that W5TTU, Pat Parks, of Rotan, Texas, became a Silent Key on Nov. 22. For ten years Pat had been struggling against serious ill health. It started with pneumonia followed by TB in one lung, which later spread to the other lung. Hospitalization, operations, bed rest were Pat's lot and though she had great inner strength and faith she grew discouraged. It was then Ham radio came into her life, via her friends W5FLJ and W5NOW, Grace. This was before the Novice license was available and Pat had to struggle to master code and theory, much of the time alone.

But her reward came with her ticket in Oct. '50 and in writing us for a report which appeared in Jan. '52 *CQ*, Pat credited Ham radio with saving her life. In June '55 *CQ* a photo

[*Continued on page 116*]

[*from page 114*]

and progress report showed Pat to be much better, happy, and deep in amateur radio with the Ladies and Knights of the Roundtable net, North Texas Emergency Net, MARS, CAP, Texas YL Round-up Net, and acting as EC for Rotan as well as YLRL 5th D/C.

On Nov. 3 Pat was rushed to the hospital in Rotan where her condition was diagnosed as a conjestive heart failure. On Nov. 13 the father of Pat's OM, Cecil, passed away with a heart attack. Pat took this bravely and on Nov. 17 was allowed to go home with her OM and son and daughter. Then on Nov. 22 another heart attack proved fatal to Pat. W5TTU has been an inspiration to many in her valiant fight against great odds. She will be greatly missed both on the air and off.

"Princess WAR WHOOP Martha"

WØZWL, Martha Shirley, has proved by her 18 years on the air that a YL can be an active amateur and that there is a place in Ham radio for women. Martha became interested in radio during the Stratosphere Flight in 1935, and her instructors were NBC engineers from NYC who also were Hams. Her ticket came on July 13, 1937, and she became the 13th licensed Ham in Rapid City, S.D. A charter member of YLRL and of the Black Hills Amateur Radio Club, she was active in AARS and has been a MARS member. A past president of the Aberdeen, S.D., Radio Club, she is asst. SCM for S.D. and ANC on Sat. for the S.D. NJQ net.

To accomplish all this Martha has kept her rig right in the kitchen so she could handle two jobs at once. The rig consists of Command transmitters for 80 and 40. Modulator is Class AB-2 with a pair of 1625's. A dipole antenna and SX-42 receiver complete the set-up. Her mobile rig is a TBS-50 and Gonset Tri-band converter. Her emergency CW rig she built herself in 1939. It is a 6F6 Pierce oscillator driving a 6L6GX, running 40 watts, and Martha says this little rig has started many Hams with their QSOs.

Chief engineer for WØZWL is her om WØYQR, and Earl and Martha have now built their retirement home about 8 miles northwest of Rapid City on 6 acres of land known as "Shirley's Antenna Farm."

Martha tells us that their 75-meter net manager organized what they call "WAR WHOOP." This is a special recognition for Net Control stations and others who have given of their time and effort at all hours of the day and night to assist with traffic handling, roll call, etc. WAR WHOOP means, "Working Amateur Radio Who Helped Out On Procedure." Each year at their state convention WAR WHOOP members gather for breakfast and elect one member to head the group for a year. Honor and a certificate are given to those who have done outstanding work during the year. This group also plans and conducts the S. Dak. QSO

Party. Last year Martha was elected to head the group and was immediately tagged "Princess WAR WHOOP Martha." Anyone interested and desiring additional information on WAR WHOOP can drop WØZWL a line at P.O. Box 41, Black Hawk, S.D.

Here and There

WAC/YL Custodian, W6PCA, Opal, has issued WAC/YL certificate No. 4 to CE5AW, Ernesto Liebrecht of Concepcion, Chile. . . . ZS6GH, Diana, informs us that ZE1JE, Molly Henderson, has her DXCC, too, and is very active on the air from Southern Rhodesia. . . . A note from VK3YL, Austine, tells us DX condx at her QTH are improving. A QSO with 3A2BH brought her total to 168 countries on 14 Mc. with 30 watts input). . . . W6WSV, Carol, says the DX bug has bitten and on 20 CW recently she had worked VS1CZ, VP8BF, XW8AB. The latter QSO'd in French and thrilled Carol by telling her her French was "tres bonne."

Via W9GME, net control for the 10-meter YL net meeting on 29,000 kc Tuesdays 1 p.m. EST, we learn this has the name "Hair Pin Net." ANC stations are K6EXQ, Connie, and W7WLX, Ethel. . . . Former W9OTM, June, is now K6MXC with QTH at 12737 Caswell Ave., Los Angeles 66. . . . W6QYL, Martha, operating fixed portable 4 from Broad Run, Va., is making a third try for YLCC.

W5EYE, Marian, keeps very busy with MARS; her Nov. report showed 88½ hours of net participation. . . . W3MSU, Ethel, besides her full-time job for the Navy, keeps on the go as secretary of the Washington Mobile Club, VP of the Washington TVI Committee, treasurer of the Society of Women Engineers, instructor at the Washington Radio Club code classes, and instructor for radiomen strikers in her Naval Reserve unit. She also is active in MARS, and the MEPN and VFN nets, and still finds time for a bit of rag-chewing on weekends.

33 till next month—*W5RZJ*

. . . de W2NSD

[*from page 13*]

forth without having to stand by. This used to be the big thing on 160M before 1940 and some roundtables of six stations or more would get going on weekends and evenings with everyone able to hear everyone else at all times. The QSO's that resulted were fun for everyone and have no resemblance to the stilted formal recitations that are all the rage today.

And autocall. There are a dozen systems which could be used to make it possible for any operator to call any other station within reliable communication range at any time he wants. Thus you could go on the air and get any specific station you want when you want

him, or you could take pot luck as with the present system. Simple? Egad, a couple of filters, diodes, and a sentitive relay hooked to a surplus Command receiver would work for the receiving end. The transmitter would need only a small two-tone oscillator. The many combinations of audio frequencies usable in a two-tone "key" would be enough to provide a practically foolproof calling system. So where are the construction articles?

Another device we should have had long ago is a PPI for use on the VHF bands. A constantly rotating antenna and sweeping local oscillator would make it possible to present the band on a 'scope so you could see the bearing and frequency of any station that was on the air. This would be to the Panadaptor what the radar PPI was to the "A"-scope.

Although it is presently frowned upon by the FCC, I think that we may see the day soon when tape recorders will play a more important part in ham radio. Things like CQ's, recitation of equipment at the station, and other repetitious stuff could well be handled by the master of repetition, the tape recorder. Even the c-w men could well use tape—they could put the info on the tape with a tone oscillator and then merely rectify this tone to drive a keying relay. The way many QSO's are run today you could put your entire contact on tape and never have to send a dit by key for hours on end.

Perhaps I sound bitter. Not really. It's just that I subscribe to the notion that things can be better than they are—that we can use our communication medium for interesting communication. How many hams have arrived at the point of Well-here-I-am-on-the-air-at-last-now-what-do-I-say? only to fall back on a sorry collection of stock cliches and phrases the first time another station says "Boo" to them, or "QRZ?", or "HW NW, OM?" In the frenzy of initiation, the delicate flower of curiosity and delight which prompted his interest in this branch of the art of Communication gets trampled on. How much Originality survives this ordeal is a matter for research. We need a good article on How to Talk on the Air, a sort of do-it-yourself Conversation Kit. (What say, Heath?)

You still don't know what to write? How about clubs? Every ham club in the country is frantic for ideas on how to hold themselves together, how to keep member interest high. If you have uncovered any mysterious secrets along this line, there are many waiting impatiently for the news. Our recent article on club bulletins started another bunch of these going and early reports indicate that the idea has worked.

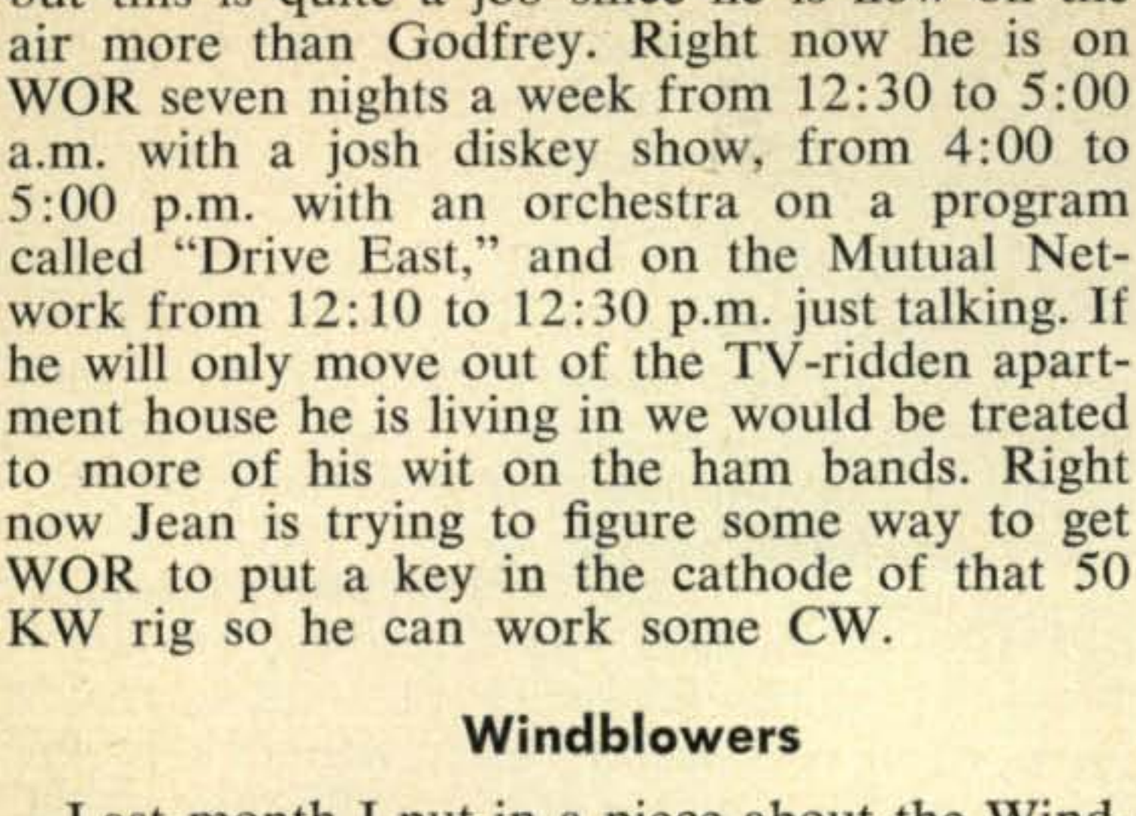
K2ORS

Quite a few of you have written in about the excellent editorials by Jean Shepherd, K2ORS. I'll try to get him to do more for us,

but this is quite a job since he is now on the air more than Godfrey. Right now he is on WOR seven nights a week from 12:30 to 5:00 a.m. with a josh diskey show, from 4:00 to 5:00 p.m. with an orchestra on a program called "Drive East," and on the Mutual Network from 12:10 to 12:30 p.m. just talking. If he will only move out of the TV-ridden apartment house he is living in we would be treated to more of his wit on the ham bands. Right now Jean is trying to figure some way to get WOR to put a key in the cathode of that 50 KW rig so he can work some CW.

Windblowers

Last month I put in a piece about the Windblowers Big Blow. Here is the certificate they



sent out to those stations that worked all four of their Big Blow stations. I intended to put the certificate in last month but ran out of room due to the last minute nature of the article.

Mountaintopping

I recently ran across a QSL that I sent out after operating atop Mt. Greylock some years back. Lest you get the idea that I am loaded

Atop Mt. Greylock

W2NSD

Portable Mobile W1

Present on this historic occasion:
Wayne Green - W2NSD
Judson Snyder - SWL
Paul Snyder - SWL
Bill Tynan - W3KMV
John Wallace - W8ZAY

Equipment used:
14½ element beam (1½ elements removed by wind)
SCR-522 xmtr-rcvr—146.88 Mc.
Two storage batteries (completely used)

Stations worked: July 12 & 13, 1947
Mass., W1AVU, KUE, PAB, JXY, OOP, PFL; **Conn.**, W1KDK, GSP; **Vermont**, W1MEP; **R. I.**, W1JFF; **New York**, W2LMF, IWI.
Tnx fr fb qso es hp cu sn agn om's

Please QSL to: *Wayne Green, 68 Pinewoods Avenue, Troy, New York*

with $$ let me hastily explain that one of the fellows who went on the trip with me was a printer and we set up the card in his shop and ran off just a handful. I'm just waiting for the winter to break a little bit so I can get at mountain-topping again. That is real sport.

RF Phase & Impedance Indicator

[*from page 57*]

Meter Types

The more sensitive the meters used with the Sensing Unit the more accurately will it be possible to balance the instrument. 20-microampere meters are recommended and can generally be found quite inexpensively on the surplus market in the form of aircraft indicators. It is desirable to use a zero-center microammeter for the phase indicator as it avoids the need to reverse the meter terminals as the sign of the reactance is changed. Because of the power-handling limitations of *R1* a maximum of about 2 Watts can be handled continuously by the Impedance Magnitude section, although several times this power might be tolerated for brief intervals just long enough to read the meter. The phase section will handle a full kilowatt continuously and can be left permanently in the antenna circuit as a check on the "flatness" of the feedline. It might also be employed as the sensing element of a semi-automatic antenna tuner.

For mobile antennas *R1* should be 50 ohms maximum. For home station use this should be increased to 500 ohms.

Calibration

Calibration is quickly accomplished by coupling the grid dip meter by means of a temporary link coil connected across *J1* and adjusting the link until a large reading is obtained on the Impedance Magnitude meter. A known non-inductive resistor should be connected across output co-ax connector *J3* and *R1* rotated until the Impedance Magnitude meter reads zero. The *R1* scale can be marked, at this point, with the value of the non-inductive test resistor. An advance rough calibration can be made by measuring with an ohmmeter between *J1* and *J2* and marking the scale of *R1* at evenly-spaced values of resistance.

The phase section can be checked by balancing *R5* for zero output to the microammeter and then varying the grid dip meter over its entire frequency range. If the phase meter does not remain at zero it shows that stray capacities are present. The terminating resistor must be connected with the shortest possible leads or stray reactance will be introduced here. When an antenna or feedline is substituted for the terminating resistor resonance can be located by tuning for zero phase-meter reading. The phase indication changes very rapidly in the vicinity of resonance.

If a *Z*-box or impedance matching roller coil is used the phase unit can be left permanently in the circuit so that readjustment can be accomplished when you QSY.

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THE LEVITTOWN SOLUTION

[*from page 31*]

second construction crew as soon as the first one is finished with its units.

Contact was made with *Gem Electronics*, Hicksville, a local wholesale house. They agreed to serve us at greatly reduced cost if we would buy in quantity. Before any money was spent on any part the construction crew was asked if any parts were available through the individuals. By not asking questions as to how and where we managed to obtain sufficient tube sockets from one chap, the resistors from another, wire from a third, and tubes from a fourth. Other components are still rolling in for these units, cutting down on the already low budget.

The cost is further reduced by this article. . . The profits from it will be distributed amongst the construction crew, and if we can talk OM Wayne Green into a constructional piece, the way we figure it, each man will not only have a mobile rig on Ten & Six, but possibly a small profit for the time he has invested.

Perhaps the biggest thing about all this is the tremendous shot in the arm it gave the *club*. As the photographs show, activity is taking place in earnest. These photos are candid, not posed. If these fellows had their way, this activity would go on five nights a week, not just two. In fact, it's so much fun working together that talk has even been heard about what we can build next!

PRINTED CIRCUITS

[*from page 21*]

If the services of a shearing machine such as used in sheet metal shops is not available, the copper-clad phenolic laminate may be cut with a fine toothed table saw or handsaw or with a fine toothed hack saw and cleaned up with a fine mill file. When sawing or filing by hand, care should be exercised to prevent chipping of the phenolic or separation of the foil. This can be best avoided by sawing or filing from the foil side and by clamping the circuit board between blocks of wood which extend up near the edge. A fine toothed table saw or band saw greatly simplifies cutting of the copper-clad phenolic laminate.

Soldering

When all holes have been punched or drilled, the components are mounted by inserting their lugs or pigtails thru the panel holes from the phenolic side. A slight bending of the pigtail is usually sufficient to hold the resistor or condenser in place during subsequent soldering.

Mass production techniques call for dipping or brushing the wired panel with the proper flux, followed by dipping (floating) of the complete circuit board and components on the surface of molten solder. Three to five seconds are usually sufficient to heat the pigtails or lugs and to accomplish a good uniform soldering job. The circuit board, when lifted from the solder pot, is tilted to permit the excess solder to drain from the circuit. Protruding pigtails are then clipped off as close to the board as possible and the surplus flux removed with alcohol and a short bristle brush.

Individual or experimental circuit boards may

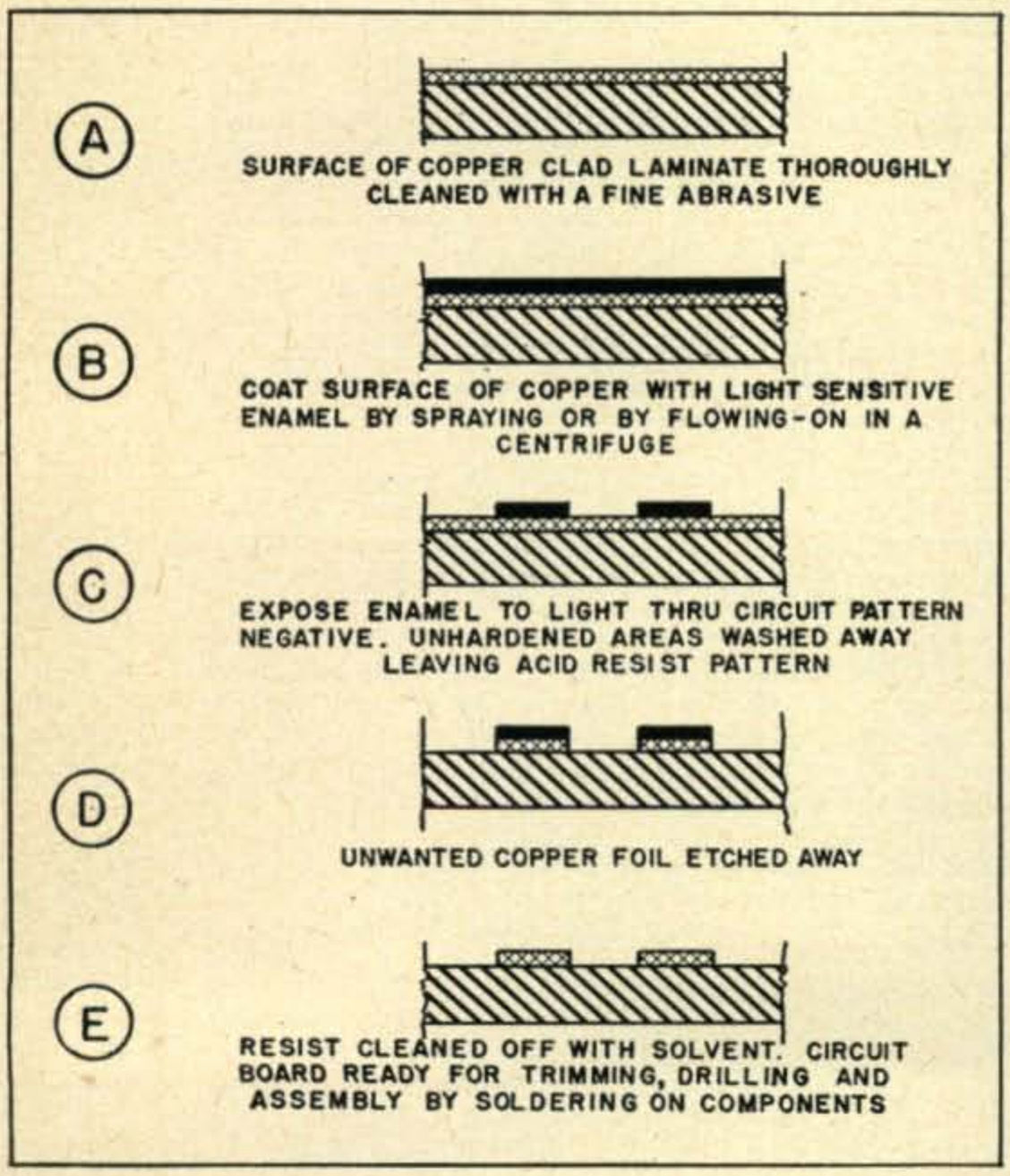

Fig. 13. Basic steps in Photoengraving.

be soldered by hand when the flux and solder pots are not justified. In this case, small, clean, well tinned pyramid tipped soldering irons of from 35-50 watts are preferred. The so-called "pencil irons" can be used without fear of damaging the panel or the copper-phenolic bond. However, faster soldering can be done with a larger (up to 150 watts) iron when experience has been gained. Excessive heat is evidenced by a snapping or frying sound indicating deterioration of the phenolic board. Conventional rosin core solder is used. *NEVER USE ACID* or other separate fluxes or serious deterioration of the dielectric will result.

(Part II, which is to appear in subsequent issue, concerns the preparation of the master drawing of the circuit layout. Suggested wiring configurations and specifications for conductor widths and spacings are considered. The simplified practices which are recommended make it possible for any amateur to produce circuit boards rivaling those of professionals.)

The Ham Shop

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CRYSTALS: FT-243's—3500 to 8700 KC ± 2KC, $1.00 each. .01% setting, $2.00 each. Hundley Crystal Co., 2951 North 36th, Kansas City 4, Kansas.

BC-223 TRANSMITTER, new, with coils, tubes; BC-645 transceiver, new; Jones MM-1 micromatch; National XCU-50Xtal calibrator; HRO-50-AC 21 Mc coil set; National Selectoject SOJ-3; TA-12 modulator; Raytheon tapped autotransformer, 1750 watts; four 4-125-A tubes, $5.00 each; two Eimac 150-T tubes, $4.00 each; 28 Mc four-element Clarkston beam; 80M B & W Balun, $5.00; 40M 274-N receivers, $5.00 each; one 80M and one 40M transmitter, $6.00 each; Miscellaneous meters, transformers. W5BNO, Box 42, Grapevine, Texas.

FOR SALE: Going mobile? A complete 6 V. mobile station. All equipment used very, very little. Like new. Elmac AF67 xmtr. PMR6A rcvr. pwr. supply for rcvr and VFO for xmtr. Carter 600V. 170 ma. dynamotor. Master Mobile all band coil and whip, $250. W8SJO, Barry Yoder, 7321 Bordman Rd., Almont, Mich.

---

10 OR 15 Mtr. Converterettes, $8.50; 25 watt 80/40mtr novice xmtr, $10.50; Eimac 4-250 tube, $18.50; 25W 10mtr. mobile xmtr, PP USA. W6RET, 862 Elm, Chula Vista, Calif.

SELL: JOHNSON Viking II, like new, $200. Hallicrafters S-76, good condition, $100. Factory-sealed Telrex 20-meter beam, $100. Heathkit VFO, $10. Curt Olofsson, W6GTY, 3809-A 18th St., San Francisco, Calif.

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TELETYPE BULLETINS. Send $5.00 for all available issues of the Amateur Radio Teletype Society Bulletin. Gives circuits and important information not available elsewhere. Get basic information on this new ham field. Write ARTS, 1379 East 15th Street, Brooklyn 30, New York.

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FREE LIST! New and reconditioned receivers, transmitters, etc. One hundred big bargains every month. Highest trade-in allowance. Write today! Dossett, W9BHV, 855 Burlington, Frankfort, Indiana.

SELL: KLEINSCHMIDT keyboard perforator for Morse code, $175; Boehme automatic keyer, $145; Model 12 Teletype complete, $125; NC-100, $95; NC-88, $85; HRO-7, $169. Tom Howard, W-1-AFN, 46 Mt. Vernon St., Boston 8, Mass. Richmond 2-0916.

TRANSMITTER-RECEIVER BC-654A. One complete except tubes, $12.00; one junk, $5.00. ARC-5 transmitters, two 4.0 to 5.3 Mc, $3.00 each; two 5.3 to 7.0 Mc, $3.00 each. Two ARC-5 receivers 6.0 to 9.1 Mc, $3.00 each. All ARC-5 units have tubes and are in good condition. W6KEG, 2142 Parkway Drive, El Monte, Calif.

SELL: VHF-152A, $40. Heath audio amp, model A-7C, $15. Arvin portable radio, $10. All work good. Bob Hartman, Dakota, Illinois.

SELL: 145-Mc 522 xmitter, mike, antennas, equipment used very little, $50. Gary Glogg, 202 9th Avenue, East Northport, N. Y.

FOR SALE: Heathkit AR-2 receiver with cabinet, $20.00; also NC-88 in perfect condition, best offer. Robert Champlin, Jr., K2BKX, 131 Bryant Avenue, Springfield, N. J.

FOR SALE: Collins 32V-3, 75A-3 with speaker. Best cash offer for either or both. Perfect condition. WØELK, 2421 Wisconsin Street, SW, Cedar Rapids, Iowa.

W1REP HAS three excellent receivers. Will sell two of the following: SX28—a real good one—just out of Douglas Labs with complete overhaul including new noise limiter, Navy HRO Model RAS 150 to 30,000 kc with seven trays (they don't build them like this anymore), includes 15-meter crystal converter and Heath Q-Multiplier, also one NC300. Prefer local deal but will deliver up to 150 miles. R. L. Gibbons, 15 Everett St., Canton, Mass.

PHONE PATCH for receivers with 500-ohm terminals. New simple operation, installation, $9.95 f.o.b. W2EEJ, 821 Rutgers Road, Franklin Square, N. Y.

PERFORATED ALUMINUM sheet, .051, 5/64" OD holes, ⅛" centers, $1.20 sq. ft., cut to size. Send for listing on beams, aluminum tubing, etc. Radcliff's, Fostoria, Ohio.

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2 METER BEAMS: 6-element, horizontal or vertical, all seamless aluminum, $6.95 prepaid. Wholesale Supply Co., Lunenburg 1, Mass.

FOR SALE: Meissner Model EX Signal shifter, $35. Complete mobile rig, Elmac A-54, Gonset Super Six, Master All Band antenna, PE-103 with 6 and 12 volt brushes, connecting cables, $125. Also an all-band 275-watt final excellent 4-125A, $50. Fine 1000v. ½ A. supply, $15. All work excellently. Paul Horton, W4TEW, 1618 N. Duke, Durham, N. C.

FOR SALE (Cont'd)

COMMAND TRANSMITTER converted for 40 Meters. Ready to go with instructions, $15.00. K2ENN, 198 Anstice Street, Oyster Bay, New York.

HEATHKIT AT-1 in excellent condition, used less than 3 hours, 4 crystals included, $27.00. KN2OEF, 45 Gramercy Park, New York City. OR. 4-3599.

SELL: ELMAC PMR 6A mobile rcvr PSR6 power supply 5 months old, $125. Babcock MT5A mobile xmtr, $75.00. SX71 rcvr spkr, $169.00. Collins 32V1 TVI'd perfect condition, $350.00. Precision E-200-C Signal generator, $35.00. Heathkit TS-3 TV alignment generator calibrated used less than 10 hours, $45.00. W8KDE, 443 5th Street, Calumet, Mich.

QSL's

QSL's: SAMPLES, dime, Print Shop, Corwith, Iowa.

QSL SAMPLES. Dime, refundable. Gale, W1BD, Waterford, Conn.

QSL's-SWL's SAMPLES. Bolles, W5OWC, 1521 Koenig Lane, Austin 5, Texas.

QSL-SWL's, Bartinoski, Williamstown, N. J.

QUALITY QSL's, Samples, 10¢. Lee, W5CZA, Box 7171, Oklahoma City, Oklahoma.

QSL's: Two colors, $2.00 hundred. Samples for stamps. Woody's (formerly Rosedale Press), Box 164, Asher Station, Little Rock, Arkansas.

QSL'S??? LARGEST variety samples 25¢ (refunded). CALLBOOKS, $4.00. Sackers, W8DED, Holland, Michigan.

QSL'S: CARTOONS, photos. Samples, stamp. Press, 5019C Gramar, Wichita, Kansas.

QSL's—SWL's! Varicolored, specialists. Samples, 10¢. W9HIU, 113 Harrison, Jeffersonville, Indiana.

QSL's—"Brownie" W3CJI, 3110 Lehigh, Allentown, Pa. Samples, 10¢, with catalogue, 25¢.

QSL's: HIGHEST quality, lowest prices. Samples, 10¢. Arcadia Printing and Duplicating, P. O. Box 474, Arcadia, California.

QSL's-SWL's high quality. Reasonable prices. Samples. Write: Bob Teachout, W1FSV, 204 Adams Street, Rutland, Vermont.

SWAP OR SELL

NEW SEALED, 4-65A (8), $10. each; new sealed, 4X150A (4), $20. each; pair Handie-Talkies (3995 kc) work, $75; Geiger counter El-Tronics SM-3, new batteries & GM tube, $135; 200 new 6J6's, $75. Want: U.S. stamps, collections or accumulations; or Elmac PMR6A or PMR7. All inquiries answered. Snow, 708 Chris Avenue, Altus, Oklahoma.

MOBILE TRANSMITTER, commercial, new, unused, 50-watt, 10 meters, swap or sell, $40. Bob Siegel, K2ILS, 130-18 223rd St., Laurelton 13, N. Y.

SELL OR TRADE Meissner model EX Signal Shifter, DB20 Pre-selector, 2 715C tubes, 1 5021 Tube, 2 sockets and 24V amp. fil. transformer. W8UAD, George Eastman, Ossineke, Michigan.

WANT: ARC-1, ART-13, ARN-7, DY-17, CU-25, APR-4, APR-9, TDQ, BC-610-E, BC-614-E, BC-939A, BC-342, BC-348, BC-312, BC-221, TS-173, TN-19, TN-54, ARC-3, 32 V, 75A, Teletype, Boehme, Technical Manuals, Test Equipment, etc. Cash or trade for New Johnson Viking, Ranger, National NC-300, Hammarlund Pro-310, HQ-140, Hallicrafters SX-100, Barker Williamson #5100B, Gonset, Elmac, Harvey Wells, Morrow, Central Electronics, Telrex, Fisher Hi-Fi, Kuehne Towers, etc. What have you to trade? Write or phone: Tom, W-1-AFN, Alltronics, Box 19, Boston 1, Mass. Richmond 2-0048. (stores: 44 Canal, Boston, 60 Spring, Newport, R. I.)

SELL OR Trade: Complete mobile rig, Babcock MT5A xmtr, PS4A pwr supply. EV Mike, Gonset Super-6 conv, noise clipper. Master Mobile whip with 80, 20 meter coils, all cables, wiring, inst. books, $150. cash or trade for good rcvr or?? W6HSO, 3193 Chase Road, Riverside, Calif.

WANTED

CASH FOR BC-610E, BC-614E, BC-939, BC-729, BC-221, BC-312, 348, TCS, AN/GRC-9 and higher, and parts for all these. AMBER INDUSTRIAL CORPORATION, Surplus Div., 75 Varick Street, N. Y.

WANTED: APS-15 or APQ-13 radar complete. W7TBE, 318 W. Galer, Seattle, Washington.

SELL YOUR back issues of CQ. We will pay 10¢ each for all issues before March 1954, in good condition. Send them to Circulation Dept., CQ Magazine, 67 West 44th St., New York 36, N. Y.

WANTED: COLLINS KW-1 transmitter. State price and condition. Also pair sound-powered phones. WØMLY, Box 185, Perry, Iowa.

WANTED: Jones Micromatch in good condition. State lowest price. Box 93G, CQ Magazine, 67 West 44, N. Y. 36.

MODULATION TRANSFORMER wanted. Need multimatch 500 watt transformer for KW rig. State make, model and lowest price. Box 17W, CQ Magazine, 67 West 44, N. Y. 36.

$200.00 OR MORE for Tuning Units TN-54/APR-4 (2,000-4,000 Mc.). Also need parts, etc. Engineering Associates, 434 Patterson Road, Dayton 9, Ohio.

AN/APR-4 tuning units, ARC-3, ARC-1, good surplus and commercial laboratory items wanted. W8KTL, Far Hills Branch, Box 26, Dayton 9, Ohio.

WANTED: TUBES—Boxed and unboxed transmitting, receiving, and special-purpose industrial types such as Klystrons, etc. Also will buy excess test gear, Hickok tube checkers, Variacs, etc. Will pay cash or swap you for choice equipment and tubes. B. N. Gensler, W2LNI, 330 West 11th Street, New York 14, N. Y.

WANTED: NEW 4D32 tube. Sell, like new, matching speaker for Collins 75A-1, $10. Roy Sawdey, 5255 Harper Road, Solon, Ohio.

TOP PRICES paid for BC-348-H,K,L,R,S. Preferably unmodified. Write, giving complete information on model, condition and best price. Industry Services, Inc., 2705 South Oakland Street, Arlington 6, Virginia.

WANTED: COLLINS 236A transmitter. W2NSD, c/o CQ Magazine, 67 West 44th Street, New York 36, N. Y.

WANTED: ELECTRONIC tubes, all types. Also want all types airborne electronic equipment: ART-13; BC-788; I-152; ARC-1; ARN/7, etc. Top dollar paid! Bob Sanett, W6REX, 1524 S. Edris Dr., Los Angeles 35, California.

MISCELLANEOUS

RECEIVERS: REPAIRED and aligned by competent engineers, using factory standard instrument. Hallicrafters, Hammarlund, National, Collins-authorized service station. Our twentieth year. Douglas Instrument Laboratory, 176 Norfolk Avenue, Boston 19, Mass.

INSTRUCTION

PORT ARTHUR COLLEGE, Port Arthur, Texas, provides training in Radio, Radar, Television necessary to pass FCC examinations for Phone and Tel licenses, 12 to 14 months. Advanced TV 6 months. Start at any level. Progress at own rate. Work toward standard. Low tuition. Board & Room at cost in dormitory. Advanced students receive on-the-job training at KPAC, 5000 watt radio station, owned & operated by the college. New courses start every 5 weeks. Approved for Veterans. Write Registrar for catalog & information.

INCREASE CODE SPEED. New method. Free particulars. D. H. Rogers, Gough Ave., Ivyland, Pa.

PASS AMATEUR theory exams. Check yourself with sample FCC-type questions & novice & general class examinations. All for only 50¢. American Electronics, 1203 Bryant Ave., New York 59, N. Y.

CQ Ad Index

Here is the first receiver in history specifically designed to include all the features most hams want at the price most hams are willing to pay.
To determine what hams really wanted, National conducted a world-wide contest, offering prizes for the best suggestions for a "dream receiver"—the receiver hams themselves considered to be ideal.
In the NC-300, "the dream comes true"—for its design incorporates all of the most-wanted features submitted in National's contest by thousands of hams.
No other receiver available is the result of such thorough searching among hams themselves to *find out* what they want most.

HERE IT IS!

he NEW NC-300 *dream receiver*

WITH ALL THESE "MOST-WANTED" FEATURES *FOR ONLY* $369.95†

eatures a total of 10 dial scales for erage of 160 to 1¼ meters with ional's *exclusive* new converter pro- n with the receiver scales calibrated 6, 2, 1¼ meters using a special 30-35 unable IF band.

ongest slide rule dial ever! Easily read- e to 2 kc without interpolation up to 5 mc.

3 position IF selector—.5 kc, 3.5 kc, t—provides super selectivity, gives opti- n band width for CW, phone, phone or VHF operation.

Separate linear detector for single side- d . . . decreases distortion by allowing C "on" with single sideband . . . will not k with RF gain full open.

Hi-speed, smooth inertia tuning dial with to 1 ratio! Provides easier, more accu- e tuning. Smoothest dial you've ever used.

Exclusive optional RF gain provision for t CW results allows independent con- of IF gain.

Big, easy to read, "S" meter.

Provision for external control of RF gain omatically during transmitting periods.

Muting provision for CW break-in ration.

PLUS—THE NEWEST LOOK IN HAM EIVERS . . . "MASSIVE IN THE MODERN NNER" . . . truly a "dream receiver" that be used either as a table or rack model.

QUENCY STABILITY
ellent as a result of using a newly de- oped high-stability capacitor plus regu- d heater and plate supplies in the llator.

NSITIVITY
db noise figure, 160-10 meters

LECTIVITY
6 db down 500 cycles, 3.5 kc and 8 kc. ectable from the front panel without itional accessories! Nothing extra to !

CALIBRATION RESET
adjustable from front panel to provide exact frequency setting!

DUAL CONVERSION
with better than 50 db primary image rejection on all amateur bands, plus better than 60 db secondary image rejection.
1st IF FREQUENCY—2215 KC.
2nd IF FREQUENCY—80 KC.

WIDE RANGE TONE CONTROL
—for control of both low frequency and high frequency end of response curve!

SOCKET FOR XTAL CALIBRATOR
plus accessory socket for powering converters and future accessories!

CRYSTAL FILTER
at 2215 kc provides notching plus 3 band width positions in addition to the 3 IF selectivity positions. No other receiver has this versatility.

14 CONTROLS

RF gain and AC on/off	
Xtal calibrator on/off	
AF gain and RF tube gain switch	
Tone control	
AM-CW-SSB-ACC switch	
CW pitch	Xtal selectivity
Main tuning	Xtal phasing
Calibration correct	Bandswitch
On/off limiter	Phono-jack
IF selectivity	

10 TUBES (Plus 4H4-C current regulator, 5Y3 rectifier and OB2 voltage regulator)

TUBE COMPLEMENT

6BZ6 RF	6BJ6 1st I.F.
6BA7 1st mixer	6BJ6 2nd I.F.
6AH6 1st osc.	6AL5 ANL and detector
6BE6 2nd mixer	6BE6 CWO/SSB det.
12AT7 1st audio and S meter amp.	6AQ5 audio output

POWER CONSUMPTION
60 watts

POWER OUTPUT
1 watt

POWER SOURCE
110-120 volts AC, 60 cycles

ANTENNA INPUT IMPEDANCE
50-300 ohms

OUTPUT IMPEDANCE
8 ohms

TUNING SYSTEM
combination gear-pinch

BAND DESIGNATION AND LENGTH

160 Meters—	1.8	to	2.0 megacycles
80 Meters—	3.5	to	4.0 megacycles
40 Meters—	7.0	to	7.3 megacycles
20 Meters—	14.0	to	14.4 megacycles
15 Meters—	21.0	to	21.5 megacycles
11 Meters—	26.5	to	27.5 megacycles
10 Meters—	28.0	to	29.7 megacycles
6 Meters—	49.5	to	54.5 megacycles*
2 Meters—	143.5	to	148.5 megacycles*
1¼ Meters—	220	to	225 megacycles*

***Usable with accessory converters**

FREQUENCY RESPONSE
200 to 3,000 cycles for communications purposes.

SHIPPING WEIGHT
60 lbs.

FINISH
two-tone gray enamel.

DIMENSIONS
19½" wide (19" rack out of cabinet)
11¼" high
15" deep

NC-300 ACCESSORIES

CONVERTERS
NC-300C6 for 6 meter band. Coverage: 49.5-54.5 mc
NC-300C2 for 2 meter band. Coverage: 143.5-148.5 mc
NC-300C1 for 1¼ meter band. Coverage: 220-225 mc

XCU-300 PLUG-IN CRYSTAL CALIBRATOR
NC-300S MATCHING SPEAKER

tuned to tomorrow

†Prices slightly higher West of the Rockies and outside Continental U.S.A.

National

61 SHERMAN ST., MALDEN 48, MASS.

RCA POWER TUBES

CLASS C POWER AMPLIFIERS AND OSCILLATORS

RCA Type	Class of Service	Max. Plate Ratings ■ DC Input Watts	DC Volts	Dissipation Watts	Max. Frequency for full Input Mc	Heater (H) or Filament Volts	Typical Operating Conditions: DC Plate Volts	DC Grid-No. 3 Volts	DC Grid-No. 2 Volts	DC Grid-No. 1 Volts	DC Plate Current Ma.	Approx. Driving Power Watts	Approx. Power Output Watts
TRIODES													
811-A‡	CW Phone	260 175	1500 1250	65 45	30	6.3	1500 1250	—	—	−70 −120	173 140	7.1 10	200 135
812-A‡	CW Phone	260 175	1500 1250	65 45	30	6.3	1500 1250	—	—	−120 −115	173 140	6.5 7.6	190 130
8005‡	CW Phone	300 240	1500 1250	85 75	60	10	1500 1250	—	—	−130 −195	200 190	7.5 9	220 170
8000‡	CW Phone	750 500	2500 2000	175 125	30	10	2500 2000	—	—	−240 −370	300 250	18 20	575 380
833-A‡	CW Phone	1000 1000	3300 3000	350 250	30	10	3000 3000	—	—	−160 −240	335 335	20 26	800 800
BEAM POWER TUBES AND PENTODES													
5618	CW	7.5	300	5	100	3.0 6.0	300	0	75	−45	25	0.2	5.4
5763‡	CW Phone	17 15	350 300	13.5 12	50	6.0 (H)	350 300	0 0	250 250	−28.5 −42.5	48.5 50	0.1 0.15	12 10
6417‡	Same as 5763 except for 12.6-volt heater												
2E24‡	CW Phone	40 27	600 500	13.5 9	125	6.3	600 500	—	195 180	−50 −45	66 54	0.21 0.16	27 18
2E26‡	CW Phone	40 27	600 500	13.5 9	125	6.3 (H)	600 500	—	185 180	−45 −50	66 54	0.17 0.15	27 18
832-A‡	CW° Phone°	50 36	750 600	20 15	200	6.3 12.6 (H)	750 600	—	200 200	−50 −70	65 60	0.24 0.21	35 26
807‡	CW Phone	75 60	750 600	30 25	60	6.3 (H)	750 600	—	250 300	−45 −85	100 100	0.3 0.4	54 44
6524‡	CW° Phone°	85 55	600 500	25 16.7	100	6.3 (H)	600 500	—	200 200	−44 −61	120 100	0.2 0.2	56 40
6146‡	CW Phone	90 67.5	750 600	25 16.7	60	6.3 (H)	750 600	—	160 150	−62 −87	120 112	0.2 0.4	70 52
4X150A‡	CW◆ Phone◆	250 200	1250 1000	150 100	500	6.0 (H)	1250 1000	—	250 250	−90 −105	200 200	1.2 2	195 140
829-B‡	CW° Phone°	120 90	750 600	40 28	200	6.3 12.6 (H)	750 600	—	200 200	−50 −60	160 150	0.4 0.5	90 70
5894‡	CW°◆ Phone°◆	120 72	600 450	40 27	250	6.3 12.6 (H)	600 450	—	250 250	−80 −100	200 150	4 0.6	85 50
4-65A	CW◆ Phone◆	345 275	3000 2500	65 45	50	6.0	3000 2500	—	250 250	−100 −135	115 110	1.7 2.6	280 230
4-125A/ 4D21	CW◆ Phone◆	500 380	3000 2500	125 85	120	5.0	3000 2500	—	350 350	−150 −210	167 152	2.5 3.3	375 300
813‡	CW Phone	500 400	2250 2000	125 100	30	10	2250 2000	0 0	400 350	−155 −175	220 200	4 4.3	375 300
4-250A/ 5D22	CW◆ Phone◆	1000 675	4000 3200	250 165	110	5	4000 3000	—	500 400	−225 −310	312 225	2.46 3.2	1000 510

MODULATORS OR RF LINEAR AMPLIFIERS (SINGLE-SIDEBAND)

RCA Type	Class of Service	Max. Plate Ratings DC Volts ■	DC Input Watts ■	Typical Operating Conditions (Two Tubes, Except Where Shown): DC Plate Volts	DC Grid-No. 2 Volts	DC Grid-No. 1 Volts	Peak AF Grid-No. 1 to Grid-No. 1 Volts	Zero-Signal DC Plate Current Ma.	Max.-Signal DC Plate Current Ma.	Plate-to-Plate Load Ohms	Approx. Max.-Sig. Driving Power Watts	Approx. Max.-Sig. Power Output Watts
829-B‡	AB_1°◆	750	100	600	200	−18	36	40	110	13750	0	44
2E24‡	AB_2	500	37.5	500	125	−15	82	20	150	9000	0.46	54
2E26‡	AB_2	500	37.5	500	125	−15	60	22	150	8000	0.36	54
6524‡	AB_2°	600	85	600	200	−26	76	21	135	11400	0.1	57
4X150A‡	AB_2◆	1250	300	1250	300	−44	100	180	475	5600	0.15	425
807‡	AB_2 B▲	750 750	90 90	750 750	300 0	−35 0	96 555	30 15	240 240	7300 6650	0.2 5.3	120 120
6146‡	AB_2	750	90	750	165	−46	108	2[illegible]	240	7400	0.04	131
5894‡	B°◆	600	120	600	250	−25	53	3[illegible]	168	8000	0.2	70
811-A‡	B	1500	235	1500	—	−4.5	170	32	313	12400	4.4	340
813‡	AB_1 s	2500	450	2500	750	−95	180	50	290	19000	0	490
810‡	B°°	2750	510	2250	—	−60	380	70	450	11600	13	725
8000‡	B**	2750	510	2250	—	−130	560	65	450	12000	7.9	725

Values shown are for Intermittent Commercial and Amateur Service (ICAS), unless otherwise indicated.

‡High Perveance Type.
°Values are for both units.
°°For af applications.
*For beam power tubes and pentodes the values shown are for mu-factor, Grid No. 2 to Grid No. 1.
**Recommended for rf applications because of low output capacitance.

◆ Values shown are for Continuous Commercial Service (CCS).
■ All ratings are Absolute Maximum values.
s Grid No. 3 connected to rear tap of filament supply.
▲ Audio driving signal fed to Grid No. 2; Grid No. 1 tied to Grid No. 2 through 20,000-ohm, 2-watt resistor.

for every transmitter need . . .

This chart has been prepared expressly for radio amateurs to show operating conditions and maximum ratings on RCA's wide line of power tubes for amateur transmitter application. High-perveance design on many of these types enables you to get the power you want at lower plate voltages. Conservative ratings assure you long hours of reliable operation.

Whether you are planning high power or low power, CW or 'phone, AM or SSB—you can rely with confidence on RCA Power Tubes. Your RCA Tube Distributor handles the entire line. For additional tube data, write RCA, Commercial Engineering, Sec. B15M, Harrison, N. J.

TUBES for AMATEURS

RCA CORPORATION OF AMERICA